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A METHODOLOGY FOR COMPARING THE VALUE OF COMPETING AFMC MANPOWER ALLOCATION STRATEGIES

THESIS

Sandra K. Smith, Captain, USAF

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This research effort develops a methodology for Air Force Materiel Command (AFMC) decision makers to use during mandated resource allocation exercises for comparing competing manpower allocation strategies. A value model is used to represent the hierarchical objectives of the command, with the primary objective being the attainment of maximum mission effectiveness in the face of constrained resources. Value model decomposition is patterned according to the command's organizational structure. Scoring functions derived using direct assessment survey techniques capture the relationship between manpower and mission effectiveness for lowest level organizations. An additive value function represents the model mathematically; the primary objective value is calculated as a weighted sum of objective values at all model levels beneath it. Results compare overall values obtained with several of AFMC's commonly used allocation strategies to values obtained with existing command manpower resources. Alternatives offering small diminishment (for mandated reductions), or great improvements (for mandated increases), from current value are the best candidates for further evaluation by decision makers. Model sensitivity to weights and to the types of scoring functions used is addressed.

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Committee:	Name/Title/Department	Signature
Co-Advisor	GREGORY S. PARNELL, Col, USAF Head Department of Operational Sciences Graduate School of Engineering	G S Parnell
Co-Advisor	JAMES T. MOORE, LtCol, USAF Associate Professor of Operations Research Department of Operational Sciences Graduate School of Engineering	James T. Moore

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THESIS

Presented to the Faculty of the Graduate School of Engineering

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Operations Research

Sandra K. Smith, B.A.

Captain, USAF

March 1995

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Preface

Changes in the national political environment and military spending alter Air Force budgets and force major command senior leadership to make difficult resource allocation decisions. It is imperative that these decisions be made in a manner that enables commands to perform effectively (optimally) with the resources that remain.

When AFMC is faced with tough manpower allocation decisions, its leaders depend on AFMC/XPM (manpower directorate) resource managers to assess the impacts of various manpower allocation strategies and make insightful recommendations. This research effort is aimed at providing resource managers with a tool to use in comparing the relative values of different resource allocation strategies, thereby developing the insight needed to assist AFMC senior leadership in making good decisions.

This study would not have been possible without the dedication of Col Jacob Kessel and the entire AFMC/XPM organization. I am particularly grateful to Major Nancy Svenson and TSgt Rich Scullion, who, without fail, would drop what they were doing to provide support for this effort.

Special thanks also go to my advisors, Col Gregory Parnell and LtCol James Moore, for their guidance, instruction, encouragement, and patience.

Finally, I give my love and gratitude to my husband Brian, my very own computer support group, for putting up with the late nights, late suppers, and for being all around supportive during my AFIT tour.

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Abstract

This research effort develops a methodology for Air Force Materiel Command (AFMC) decision makers to use during mandated resource allocation exercises for comparing competing manpower allocation strategies.

A value model is used to represent the hierarchical objectives of the command, with the primary objective being the attainment of maximum mission effectiveness in the face of constrained resources. Value model decomposition is patterned according to the command's organizational structure. Scoring functions derived using direct assessment survey techniques capture the relationship between manpower and mission effectiveness for lowest level organizations. An additive value function represents the model mathematically; the primary objective value is calculated as a weighted sum of objective values at all model levels beneath it.

Results compare overall values obtained with several of AFMC's commonly used allocation strategies to values obtained with existing command manpower resources. Alternatives offering small diminishment (for mandated reductions), or great improvements (for mandated increases), from current value are the best candidates for further evaluation by decision makers. Model sensitivity to weights and to the types of scoring functions used is addressed.

A METHODOLOGY FOR COMPARING THE VALUE OF COMPETING AFMC MANPOWER ALLOCATION STRATEGIES

I. Introduction

Background

As Air Force budget dollars fluctuate due to changes in national military spending, Air Force major commands (MAJCOMS), such as Air Force Materiel Command (AFMC), are forced to reallocate resources. In some contexts, explicit directives from Air Staff make the resource reallocation straightforward. In other contexts, particularly in the manpower resource arena, this is not the case, and the burden of decision falls directly on MAJCOM shoulders. In AFMC's case, the organization specifically responsible for making manpower allocation recommendations is XPM, the manpower resources directorate.

The selection of manpower authorizations to adjust is a difficult decision making process. In the past, AFMC/XPM manpower reallocation exercises have been tedious. Varying constraints and guidelines during successive exercises made the search for a consistent, defining methodology for the process difficult. Yet, XPM decision makers have identified the need for an analysis approach, model, or tool that could help AFMC/XPM consider manpower resource prioritization in an integrated framework of economics, politics and war-fighting capability.

Several basic characteristics of manpower allocation exercises make the decision process an arduous one and provide requirements for any potential solution methodologies. They are as follows:

1. As is natural for any problem that alters resource levels, trade-offs must be made between multiple conflicting objectives. For AFMC, the conflicting factors are the command's many different organizations, whose effectiveness in performing militarily valuable missions will be impacted by manpower changes. The trade-off decisions that must be made are especially tough for AFMC since effectiveness is difficult to compare across diverse functional elements and programs.

2. The involvement in the decision making process of the diverse functional managers, or Mission Element Board (MEB) members, who feel strong ownership for "their" programs and manpower authorizations requires a methodology for iterative group decision making that gives quick answers and provides insight into what is driving end results.

3. One of the most difficult aspects of the prioritization problem is that any methodologies provided must be generic in application, since the specific problem parameters change from one exercise to the next. In other words, each time an allocation exercise takes place, there are different guidelines and constraints that govern what manpower changes can be made, and successful implementation of a solution technique in one instance does not imply success for future applications under different circumstances. Methodologies must be robust enough to incorporate different constraints for different

situations, but must be simple enough that decision makers can easily understand them and use them to model particular situations.

Problem Statement

AFMC/XPM resource managers have limited methodologies for assessing the impacts of competing manpower allocation alternatives on overall AFMC mission accomplishment. Without such information, they are often forced to recommend equal percentage changes across organizations.

Research Objective

It is the purpose of this research effort to develop a methodology that can be used by AFMC/XPM resource managers to compare the competing manpower allocation strategies developed during a resource allocation exercise.

Scope

This research does not attempt to develop manpower allocation alternatives for consideration by resource managers. Instead, it provides a methodology for comparing the alternatives generated during another phase of the decision making process. It is assumed that the parameters of the particular exercise and the constraints associated with it would be taken into consideration during the alternative development phase, and that only those alternatives which succeeded in meeting exercise constraints would be presented to this model.

Overview

Chapter II provides a review of the literature pertinent to a decision making approach called Value Focused Thinking.

Chapter III presents detailed background for the research conducted, describing AFMC and the process by which its manpower directorate, AFMC/XPM, develops resource allocation recommendations.

Chapter IV describes the methodology for developing the value model and presents a description of the model.

Chapter V presents the results of the research and analysis of those results.

Chapter VI contains conclusions drawn from the analysis in Chapter V and makes recommendations for additional research.

II. Literature Review

Introduction

The basic difficulty underlying the AFMC manpower decision making process is one of multiple conflicting objectives. AFMC has a specified mission to accomplish (refer to Chapter III), and it can be assumed that accomplishment of this mission with maximal effectiveness given available resources is the primary goal of the command. In actuality, the AFMC mission is comprised of many diverse functions, where the accomplishment of each can be viewed as a fundamental objective of the command. When AFMC is forced to make changes to existing command manpower resource levels to achieve mandated manpower endstrengths or meet budgetary constraints, the level of maximal AFMC mission effectiveness is bound to change, as will the level of attainment of each fundamental objective. If it is assumed that allocation of manpower toward a particular fundamental objective prohibits its use toward another objective, then necessarily the fundamental objectives will conflict. Since feasible manpower allocation alternatives do not allow high achievement of conflicting fundamental objectives simultaneously, decisions made in allocating manpower resources to meet new constraints must consider the importance of each fundamental objective in light of the primary command goal (3:431).

Many decision analysis techniques deal with the comparison of alternatives in making decisions with multiple conflicting objectives. One such methodology is particularly useful for making resource decisions because it focuses, not on the possible alternatives, but on the values of the decision makers. Developed by prominent decision analyst Ralph Keeney, it is called Value-Focused Thinking (8).

Value-Focused Thinking

Value-Focused Thinking (VFT) is a straightforward way of dealing with conflicting objectives. Many typical decisions are made by decision makers taking stock of the available alternatives, assessing the pros and cons of each, and choosing the one that seems to result in the best trade-off among objectives. VFT takes a different approach. It stresses the importance of the objectives, instead of the alternatives, as it is the attainment of them that provides value to the decision maker. The primary goal is viewed as the combined achievement of some set of fundamental objectives. Each fundamental objective is broken into subobjectives, which in turn, are broken into sub-subobjectives until a complete model of the decision maker's objective hierarchy, called a value model, is created (8:77-87, 130-132).

Development of Value Models and Value Functions

Once a value model has been created, it can be represented by a mathematical value function, the purpose for which is the calculation of an overall value score for any decision alternative. Basically, value scores are calculated for each objective, weighted according to the relative importance of the various objectives, and summed[1] (3:431).

[1] Value functions are found in decision analysis literature under many names. Keeney and Raiffa provide a complete list, including preference functions and utility functions (7:68).

There are several steps in the formulation of a value function. The first step in the process, the determination of relevant objectives for building the value model objective hierarchy, has already been discussed. The next step involves measurement of the performance of competing alternatives in meeting the established value model objectives (3:431). This is accomplished through the assignment of a measurable attribute to each of the lowest-level objectives (7:49). Using the assigned attributes, each decision alternative is scored on the extent to which it satisfies the corresponding objective.

The development of appropriate attributes and scoring methods is necessarily specific to the task, or decision problem, at hand. In some instances, when measurable attributes cannot be found for lower-level objectives, it may be necessary to depend on subjective indexes, proxy attributes, or direct preference measurements.[2]

The final step in the value function development process requires the establishment of a weighting scheme reflecting the relative importance of each objective at each level in the hierarchy. Again, there are numerous ways of approaching this task. Subjective assessment of each objective's importance by decision makers is one possibility. Another method utilizes revealed preferences, where a decision maker's past actions and decisions are studied to derive a preference structure for current objectives. This technique is dependent on the assumption that a decision maker's choices in the past were directed towards achieving optimal solutions (7:18).

[2] Keeney and Raiffa provide a detailed discussion of these techniques (7:55-62).

Additive Value Function Assumptions

If the objectives in the value model hierarchy interact in any way (e.g., achievement in one area is dependent on achievement in another area, achievement in one area substitutes for failure in another area, achievement in one area grows synergistically with achievement in another area), the value model and its associated mathematical function can be very complex. Yet, a very simple value function form, associated with an additive value model, can be appropriate for many decision contexts if some basic assumptions are met (7:80). The following independence conditions must be satisfied for an additive value function to give an appropriate representation of the problem:

1. mutual preferential independence,
2. mutual utility independence, and
3. additive independence.

Preferential independence exists between attributes when preferences for sure outcomes in one attribute do not depend on the level of other attributes.[3] The stricter condition of utility independence requires that preferences for gambles in one attribute do not depend on the other attribute levels. Additive independence is an even stronger requirement, where preferences over lotteries in one attribute must not depend on lotteries in other attributes[4] (3:492). A consistency check for the use of an additive value function is that weights assigned across a set of subobjectives, reflecting the relative importance of those objectives, sum to one.

[3] For mutuality, the relationship must hold in both directions.
[4] A detailed description is given, along with examples and assessment strategies, of each independence condition (3:477-484).

III. Background

AFMC Manpower Structure

In 1991, two Air Force major commands, Air Force Logistics Command (AFLC) and Air Force Systems Command (AFSC) merged to from Air Force Materiel Command (AFMC), headquartered at Wright-Patterson Air Force Base, Ohio. The missions of both original commands were incorporated into a new mission, cited below:

> Through the integrated management of research, development, test, acquisition, and support, we advance and use technology to acquire and sustain superior systems in partnership with our customers and suppliers. We perform continuous product and process improvement throughout the life cycle. As an integral part of the Air Force War Fighting Team, we contribute to affordable combat superiority, readiness and sustainability (14).

The former AFSC commander, General Ronald Yates, was given the reigns of the newly formed AFMC. Since his assumption of command, General Yates has overseen several reorganizations and restructurings designed to better enable AFMC to use its allocated resources and fulfill its mission.

According to the most recent organizational restructuring (per AFMC Objective Blueprint dated 1 Oct 94), AFMC is responsible for managing and maintaining the fourteen Air Force Bases (or Air Bases) where the majority of its resources are located. The command is comprised of nineteen subcommands, in addition to the headquarters itself. Among these are the three well-known test centers (AEDC, AFDTC, and AFFTC), four product centers (ASC, ESC, HSC, SMC), and five air logistics centers (OC-ALC, OO-ALC, SA-ALC, SM-ALC, WR-ALC.) The remainder is comprised of a variety of smaller organizations such as the AMARC, AGMC, etc. Table 1 contains a complete listing of AFMC subcommands. Subcommands are in turn divided into two-letter organizations.

Table 1. AFMC Subcommands

Arnold Engineering Development Center (AEDC)
Air Force Development Test Center (AFDTC)
Air Force Flight Test Center (AFFTC)
Air Force Museum (AFMUSEUM)
Air Force Security Assistance Center (AFSAC)
Aerospace Guidance and Metrology Center (AGMC)
Aerospace Maintenance and Regeneration Center (AMARC)
Aeronautical Systems Center (ASC)
Cataloging and Standardization Center (CASC)
Electronic Systems Center (ESC)
Field Operating Agencies (FOA)
Headquarters Air Force Materiel Command (HQAFMC)
Human Systems Center (HSC)
Joint Logistics Systems Center (JLSC)
Oklahoma City Air Logistics Center (OC-ALC)
Ogden Air Logistics Center (OO-ALC)
San Antonio Air Logistics Center (SA-ALC)
Sacramento Air Logistics Center (SM-ALC)
Space and Missile Systems Center (SMC)
Warner Robins Air Logistics Center (WR-ALC)

At first look, these subcommands appear to be clearly divided by mission area (e.g., test, product development, maintenance.) Indeed, from a resource allocation perspective, accomplishment of the AFMC mission, discussed previously, is divided into five primary mission element areas, as follow:

1. Product Management (PM),
2. Science and Technology (S&T),
3. Test and Evaluation (T&E),
4. Sustainment and Industrial Operations (S&IO), and

5. Base Operating Support (BOS).

For the most part, the mission of each subcommand, or center, falls directly under one of these mission element areas. There are, however, a few exceptions. The S&T mission element area incorporates the missions of AFMC's four laboratories, even though, structurally, they belong to each of the four product centers, and the BOS mission element area, by its very nature, incorporates any of the AFMC subcommands which depend on one of the AFMC Air Force bases for support. Table 2 depicts the relationship between the centers and the mission element areas.[5] Each mission element area is overseen by a Mission Element Board (MEB) which represents the area's interests and resource requirements to the command.

Table 2. Relationship Between MEBs and AFMC Center Missions

PM	S&T	T&E	S&IO	BOS
ASC	ARMSTRONG LAB	AEDC	OC-ALC	AEDC
ESC	PHILLIPS LAB	AFDTC	OO-ALC	AFDTC
HSC	ROME LAB	AFFTC	SA-ALC	AFFTC
SMC	WRIGHT LAB		SM-ALC	AFMUSEUM
			WR-ALC	AFSAC
				AGMC
				ASC
				CASC
				ESC
				FOA
				HQAFMC
				HSC
				OC-ALC
				OO-ALC
				SA-ALC
				SM-ALC
				SMC
				WR-ALC

[5] For the purpose of this research, AFMC's laboratories are treated as centers, even though they do not bear a center designation.

Although the MEB structure provides clear definition for certain types of resource allocation, difficulties begin to arise when this command structure is viewed with a focus on manpower allocation. Although the majority of manpower authorizations at each subcommand fall under its primary mission area, each subcommand can own positions that fall in each of the other areas. This is due to the fact that manpower positions are managed, not according to the command's organizational structure, but by program element code, or PEC. PECs are the funding codes that tie manpower authorizations to Air Force (DOD) program dollars. It is the AFMC PECs that are divided into mission element areas for MEB management; thus, manpower authorizations must be managed and assigned by MEB, also. Since a single subcommand can be involved with work on many funded program elements, it is often the case that it ends up with manpower resources belonging to different MEBs.

Making matters even more complex, manpower positions can be viewed and managed for some purposes from yet another orientation, that is, by functional account code, or FAC. Some examples of AFMC functional areas are logistics, engineering, and contracting. It is easy to see that AFMC, from a manpower standpoint, is not so neatly defined as may be thought at first glance.

AFMC Manpower Data

Currently, AFMC/XPM is responsible for over 150,000 manpower authorizations. Managing all of these resources requires a tracking system that provides insight into manpower allocation by the previously discussed organizational structure, mission areas, and program element codes (PECs) as well as many other factors. The Command

Manpower Database, or CMDB, is the tool that is used. This database, which is updated quarterly, contains a record for every AFMC authorization. It contains information on existing command manpower authorizations as well as projections for resource levels several years into the future. Thirty data fields for each record provide access to required information pertaining to a particular authorization.

The information contained in the CMDB is used by AFMC/XPM for an entire realm of manpower actions and decisions. Only a subset of this information is required for making the decisions involved in a mandated manpower allocation exercise. Therefore, the fields utilized in this research are limited to the following: Mission Element Board (MEB), subcommand, laboratory name, organizational structure code (two-letter organization), base location name, functional account code (FAC), program element code (PEC), and current year authorization.

<u>Manpower Allocation Process</u>

Major manpower allocation decisions are made at the command level (i.e., AFMC) in response to mandate by senior Air Force leadership, as well as to needs identified within the AFMC command structure. As the command's Organization and Manpower Directorate, AFMC/XPM is responsible for conducting manpower allocation exercises to support the command's decision making process. The goal is identification of potential solution alternatives for recommendation to senior leadership. Although this responsibility lies with XPM, the manpower resources are "owned" by the center and organization commanders. Their involvement in manpower allocation exercises and subsequent decision making efforts is facilitated through the five Mission Element Boards (MEBs), the chairpersons of which forward their interests and resource requirements to the command senior leadership. Since each MEB is comprised of all subcommand (center) commanders with resources in that mission element area, it is chaired by the two-letter organization at the HQ AFMC level that is appropriately related to that mission area. Thus, the MEB chairpersons form the link between the organizational structure of the command and the superimposed mission element structure by which resources are managed. The relationships between HQ AFMC two-letter commanders and the five MEBs are depicted in Table 3.

Table 3. Relationship Between HQ AFMC Two-letter Commanders and MEBs

HQ AFMC Two-letter Commander	Chairs MEB
XR	PM
ST	S&T
DO	T&E
LG	S&IO
CE	BOS

The process by which AFMC/XPM conducts a major manpower allocation exercise begins with a Resource Allocation - In Process Team (RA-IPT) being formed to ensure that all interested parties are involved. Although the five MEB chairpersons, or "chiefs", function as the RA-IPT's sole voting members, attendance and input from the remaining HQ AFMC two-letter organizations is welcome. AFMC/XPM presents the requirements of a particular exercise to the RA-IPT members. They work together to generate viable manpower allocation alternatives for evaluation by command leadership, attempting to balance the needs of each of the RA-IPT's voting members and the MEBs they represent while meeting the constraints presented by the particular exercise. An iterative process continues with XPM formulating explicit numerical solutions to represent the more general decisions made during RA-IPT meetings and presenting them back to the RA-IPT for acceptance. This loop is often repeated several times, requiring an extensive expenditure of time and effort by the XPM resource managers.

One of the reasons this process is so time and effort consuming is that within the framework of any manpower allocation exercise, the requirements and constraints to be taken into consideration can be very involved. For instance, a manpower adjustment target may come down from Air Staff in the form of a monetary value or in the form of a manpower endstrength to be reached by some fiscal year point. The particular programs affected may or may not be specified. Sometimes only specific manpower categories (i.e., officer/enlisted/civilian) or types of organizations (e.g., those with DMBA funds) are targeted. Organizations may be fenced, or removed from consideration, even though their resources match the requirements of the exercise in every way. The complicated constraint framework and lengthy RA-IPT process has frustrated XPM resource managers for years. A frequent fallback position, simplifying the situation, has been a peanut butter spread allocation across all viable organizations.[6] Yet, intuition postulates that this is not near an ideal solution where the logical goal is attainment of optimal command performance with a given set of manpower resources. Thus, although this and other XPM alternatives have been accepted by the RA-IPT and implemented by command decision makers, there is a feeling that with added insight, XPM resource managers could find and present better solutions.

[6] AFMC/XPM refers to an equal percentage allocation across all organizations as a peanut butter spread.

Model Context

Any modeling tool developed for providing assistance to AFMC/XPM during a manpower allocation exercise should focus on the following:

1. Simplifying the framework of requirements and constraints to be handled,
2. Shortening/automating the lengthy RA-IPT process, and
3. Providing insight into the relationship between AFMC manpower resources and the command's ability to perform its mission.

The former parts of this problem are addressed by another research effort.[7] The third goal above is the focus of this research effort and the associated model.

[7] A study is currently being done to automate the reduction of manpower authorizations considered during the RA-IPT process to meet the constraints and parameters of a particular allocation exercise (2).

IV. Methodology

Value Model Development and Description

This research effort uses a Value Focused Thinking (VFT) approach because of its ability to model overall AFMC command mission effectiveness as a function of the mission effectiveness of the command's smaller organizations. The value model can be depicted as a tree hierarchy representing a fundamental objective repeatedly divided into subobjectives until quantifiable attributes are reached at the lowest tier. This tree representation allows insight into the role each element of the hierarchy plays in contributing to the overall objective; in this case, overall AFMC mission effectiveness. The complete value model developed for this study is presented in Appendix A.

TIER I. The top tier, or Tier I, of the value model represents the entire AFMC command, whose optimal mission effectiveness in the face of constrained resources is the fundamental objective to be captured. If the concept of overall command effectiveness as related to manpower allocation were easily quantifiable at this level, the value tree representation could be terminated at the top tier. Command level decision makers could calculate the impact of all manpower allocation alternatives and choose the best one. Yet, it has already been determined that this is not the case. Command decision makers do not simply hand down guidance for manpower allocation each time a resource change is mandated. Instead, they require the time and effort intensive insight into the decision making process that is provided through AFMC/XPM and the RA-IPT conducting a manpower allocation exercise. Thus, another tier in the value model hierarchy is required.

TIER II. The choice of a breakdown strategy to be employed at Tier II appears straightforward. Since the AFMC/XPM manpower allocation exercise process is undertaken with a viewpoint of the command and its resource requirements by mission element area, the division of AFMC in the value model by MEB is an ideal choice. The ensuing value model tier represents five subobjectives, each of which is the attainment of optimal MEB mission effectiveness in the face of constrained resources.

At this point, it is again important to consider whether or not the relationship between manpower and achievement of these subobjectives is easily quantifiable. If it were, MEB chiefs could easily assess the impacts of manpower changes on the abilities of the center and organizations they represent to sustain their respective missions. Resulting assessments, summed across the five MEBs and weighted relative to each MEB's importance to the command, would represent overall command effectiveness. There would be no need to model further; but again, this is not the case. As mentioned in Chapter III, each MEB represents multiple subcommands. With the enormous variety of mission functions performed by each subcommand, there is little chance that a single MEB chief could have the insight required to successfully evaluate manpower allocation alternatives; thus, it is necessary to continue developing the model to a level where quantification of the relationship between manpower allocation and mission effectiveness is achievable.

TIER III. A strategy for further division of the MEBs is not quite as obvious as the one presented at the previous tier. However, recalling that each MEB is comprised of the primary subcommand, or center, commanders whose resources fall in that mission element area, an appropriate choice for a Tier III division would seem to be each of the centers employing MEB resources. Although most of the resources in an MEB are assigned to one of its primary centers (refer to Table 1), due to the complexity of the MEB structure, some MEB resources fall outside those centers. In addition, some centers are primary resource owners in more than one MEB, typically BOS and one other MEB. This does not pose a problem as long as the model is carefully set up to distinguish between manpower authorizations that belong in each MEB and not duplicate them. Within each MEB, resources not captured by one of the primary Tier III centers are combined and evaluated as a single additional center. (Refer to the next section for assumptions and simplifications.)

Following the model pattern established by the existing tiers, it is possible to characterize the value of Tier III, again, as a series of subobjectives, each one being a center's mission effectiveness in the face of constrained resources. The first three tiers of the value model are shown in Figure 1.

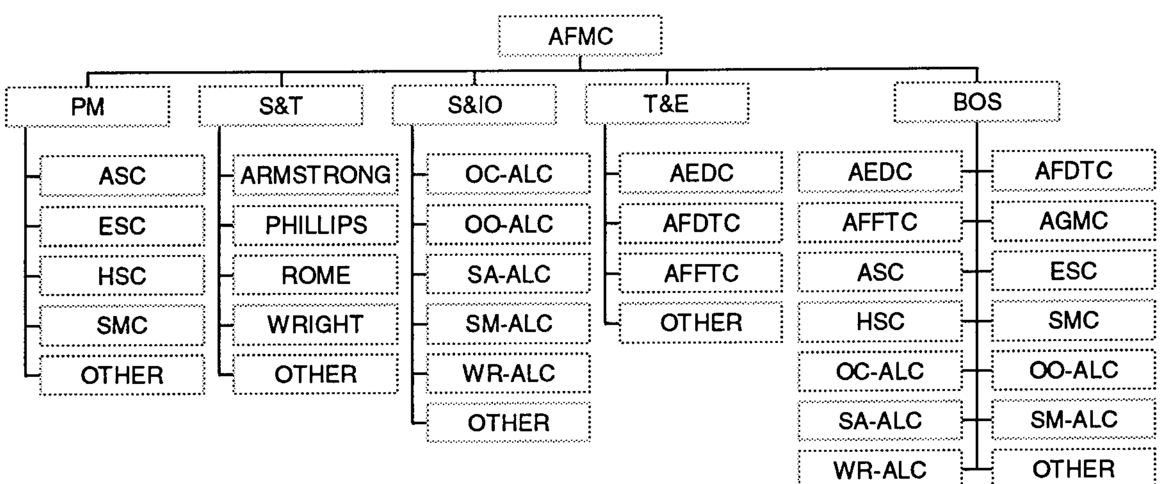

Figure 1. Upper Tiers of the Value Model

Once again, it is advantageous to consider whether or not further breakdown of the value tree is necessary, or if quantification of the relationship between manpower allocation and mission effectiveness is possible at this level. The problem with quantification at this tier is that centers, although more narrowly focused than MEBs or major commands, still encompass many smaller organizations whose missions span a variety of programmatic and functional areas. Further breakdown into units with unique, narrowly directed missions that provide access to performance measurement is required.

TIER IV. Recalling earlier discussion, several potential choices for the division of Tier III centers are apparent, including breakdown by functional account code (FAC), program element code (PEC) and structural organization (two-letter). The following are the requirements considered in the selection of a Tier IV breakdown strategy:

1. There exists, conceptually, some appropriate measure of effectiveness (MOE), or metric, for explicitly assessing the impact of a manpower change on mission effectiveness for each Tier IV unit.

2. There exists, realistically, the available data or subjective insight required for utilization of the selected MOE.

3. Mutually exclusive and collectively exhaustive incorporation of all AFMC manpower assets is feasible at Tier IV using this breakdown scheme.

After in-depth evaluation of the ability of each potential breakdown scheme to meet these requirements, Tier IV breakdown by organizational structure, (two-letter organization), was selected as the most viable approach.

In general, the FAC code alternative fell short of meeting the first two requirements. Functional accounts, of which there are 1,317 in AFMC, identify "homogeneous groupings of tasks" (14). They are inherently detailed and explicit, providing insight into the types of skills required by different manpower authorizations. Basically, there are no metrics for mission effectiveness at such a detailed level, and the level of responsibility for, and thus visibility into, mission accomplishment may encompass any number and variety of FAC codes.

On the other hand, with only 279 program elements in AFMC, each seemingly possessing a tie to program importance at the AF/DOD budget level, PEC code seems an ideal basis for Tier IV breakdown. However, the PEC breakdown alternative also falls short on the first two requirements. Interviews with HQ AFMC MEB focal points for program and organizational metrics were helpful in determining that metrics for mission effectiveness, and responsibility for mission accomplishment, do not exist at the individual PEC level (1; 4; 11; 12).

Although it has none of the inherent attractiveness that functional or program related schemes have, breakout by organizational structure, or two-letter organization, successfully meets each of the above requirements. Due to the very nature of the two-letter as the fundamental building block of AFMC's organizational structure, subjective assessment of the impact of manpower changes on effectiveness in performing a unique and narrowly scoped mission is attainable, if from none other than the two-letter organization's commander/director. In addition, the model for the Tier IV breakdown as a mutually exclusive and collectively exhaustive set already exists as the command's organizational structure. However, since inclusion of AFMC's 741 total two-letter organizations would require excessive data collection from busy organization commanders, Tier IV will be handled in a similar manner to Tier III. Only the two-letter organizations employing the majority of the manpower resources in each center are modeled explicitly. The other two-letter organizations at each center are combined and incorporated as a single two-letter organization, resulting in a total of 268 Tier IV organizations.

Model Assumptions and Simplifications

It is necessary to make certain assumptions and simplifications in order to complete the development of the value model. They are as follows:

1. Model outcomes are based on organizational manpower totals including officer, enlisted, civilian, and contracted military equivalent (CME) authorizations. Although CME positions are untouchable during a manpower resource allocation exercise, they reflect an existing level of effort being applied toward organizational mission accomplishment, and thus are considered in establishing weights and determining current manpower levels.

2. The HQAFMC subcommand is excluded from this study , since manpower resource allocation to the headquarters is not controlled by the RA-IPT process at which this research is directed.[8]

[8] HQ AFMC resources are only 1.23% of total AFMC manpower resources.

3. It is not necessary to explicitly model every organization at every tier. As long as the majority of organizations with large numbers of manpower resources are modeled explicitly, the remaining small organizations can be grouped as an individual unit without loss of insight.

4. An additive value function is used to mathematically represent the value model since the required assumptions of preferential, utility, and additive independence appear to make good sense. Specifically, for any modeled organization, a large allocation of manpower should be preferred to a small one, regardless of the manpower allocation levels in other organizations.

5. As discussed in Chapter II, typical value model applications rely on a two-step process for quantification of values at the bottom tier of the model (i.e., assigning a quantifiable attribute to each two-letter and then measuring the organization's performance against it for any allocation alternative.) In lieu of this, the ability of each organization to perform its mission based on allocated manpower is captured directly by subjective assessment.

6. Data collected from the field relies on an implicit understanding of the concept of 100% mission effectiveness as a level of accomplishment coincident with an appropriate quality of performance (e.g., no excessive backlog is created; nor is the level of service above what is actually required.) It also requires an understanding that manpower resource levels identified as being able to achieve a certain level of mission effectiveness should be those that can sustain that level of effectiveness for an indefinite period of time.

Tier IV Value Quantification

The purpose in constructing the value model hierarchy is to enable XPM resource managers to gain insight into the "unquantifiable" AFMC command (Tier I) mission effectiveness in terms of "quantifiable" two-letter organization (Tier IV) mission effectiveness. Thus, it is necessary to develop a measure of the value that each Tier IV organization provides. This can be accomplished for each using a scoring function, which essentially maps the manpower level attributed to a two-letter organization (by an allocation alternative) to a mission effectiveness value, based on the relationship of manpower and mission effectiveness in that two-letter.

Scoring Functions. The scoring functions used in this research to relate two-letter organization manpower level to mission effectiveness are of the following four types: linear, concave, convex, and S-curve. Figure 2 demonstrates the shape of each of these functions.

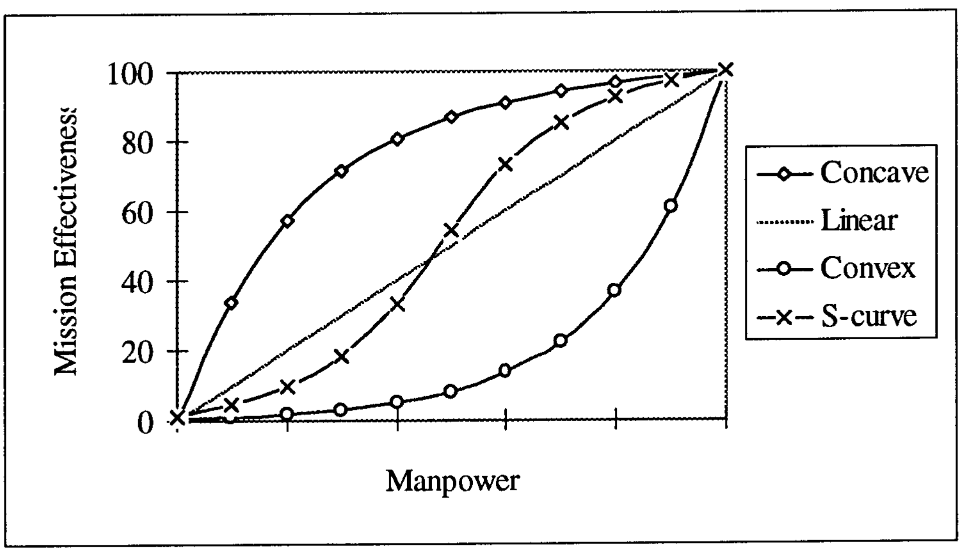

Figure 2. Sample Scoring Functions

A convex scoring function is used to model value for organizations that experience major improvements in effectiveness for minor increases in manpower when manpower levels are close to optimal (i.e., at the top of the curve.) At the opposite extreme, a concave function is used to model value for organizations that experience minor improvements in effectiveness for major increases in manpower when manpower levels are close to optimal. A linear scoring function represents an equivalent percentage change in effectiveness per change in manpower, regardless of the manpower level. The S-curve combines each of the previous functions at different points (i.e., convex for low manpower levels, concave for high manpower levels, and linear in between.) As an example, the S-curve would be appropriate for modeling the value of an organization that requires a fair manpower allocation for any effectiveness to occur but receives diminishing returns in effectiveness for manpower increases at high manpower levels.

In order to determine which of the above types of curves is appropriate for each Tier IV two-letter and to derive the specific parameters of the scoring functions for each, it is necessary to capture the relationship that exists between manpower and mission effectiveness in each two-letter organization. Appropriately, the Tier IV breakdown methodology was chosen primarily due to the availability of subjective insight into this relationship. A mission effectiveness survey was developed as a tool for gaining the required information directly from each two-letter organization commander/director. Assistance from AFMC/XPM's modeling support team was sought in developing appropriate survey questions. (5; 6; 13; 14) The resulting mission effectiveness survey and the survey responses collected are included as Appendices B and C.[9]

After the survey data was collected, a mathematical applications package was used to derive appropriately shaped polynomial curves or piecewise linear functions as scoring functions for each Tier IV organization.[10] Lower and upper bounds exist for each organization's scoring function. The lower bound occurs at the level of manpower below which the organization is effectively broken. The upper bound is the manpower level at which 100% mission effectiveness is attained. Manpower allocations outside these bounds result in scores of 0 and 100, respectively. Coefficients and bounds for each scoring function are shown in Appendix D.

Since scoring functions could only be assessed directly from the data for Tier IV two-letters who returned mission effectiveness surveys, alternative ways of developing scoring functions had to be developed for the remaining organizations. Development methodologies fall into the following four categories:

1. Category 1 consists of two-letter organizations modeled explicitly at Tier IV, for which data was attainable. Scoring functions were developed directly from the collected data.

2. Category 2 consists of two-letter organizations modeled explicitly at Tier IV, for which data was unattainable. Scoring functions for these two-letters were patterned after those of category 1 organizations with similar organizational functions.

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[9] Survey responses were obtained indirectly from two-letter commanders/directors by AFMC/XPM mission element area liaisons.

[10] Mathcad® 4.0 (9).

3. Category 3 represents the two-letter organizations combined and modeled as single organizations within each center. Scoring functions were developed using data averaged across category 1 organizations in the respective center.

4. Category 4 represents the centers combined and modeled as single organizations within each MEB. These scoring functions were developed using data averaged across category 1 organizations in the respective MEB.

Table 4 and Figure 3 show the percentage of AFMC resources that fall into each of the four categories.

Table 4. Resources by Scoring Function Development Category

CAT4	16%	5%	2%	8%	3%	7%
CAT3	6%	7%	14%	2%	26%	10%
CAT2	8%	85%	31%	39%	37%	36%
CAT1	70%	3%	53%	51%	34%	47%
	PM	**ST**	**TE**	**SIO**	**BOS**	**TOTAL**

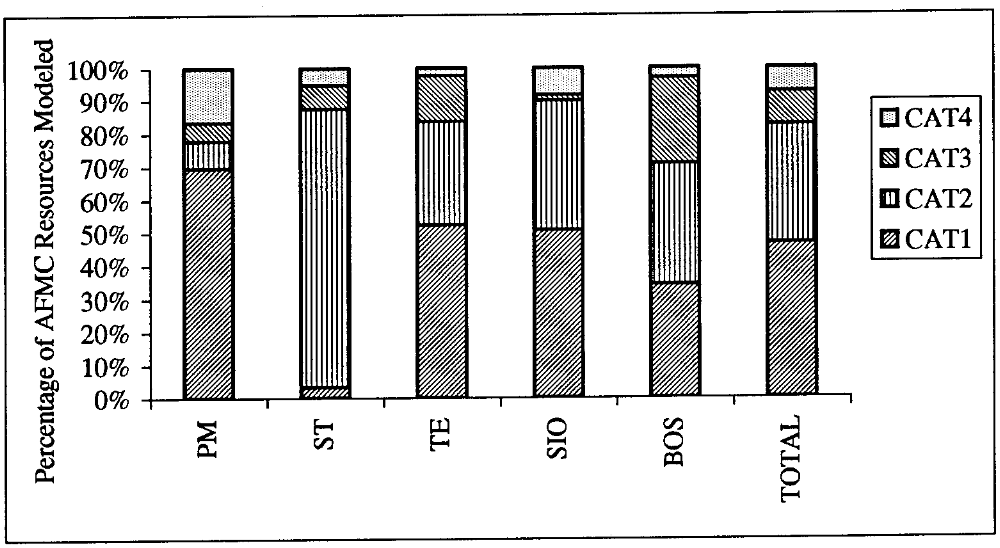

Figure 3. Resources by Scoring Function Development Category

Value Model Weights

As discussed in Chapter II, the final step in the value function development process is the establishment of a weighting scheme that reflects the relative importance of each objective at each tier in the hierarchy. Since computation of the overall value to AFMC of a particular manpower allocation strategy relies on the weighting factors used, it is important that the selection of weights be given careful thought. Recall that Tiers II through IV of the model hierarchy represent subobjectives, and that achievement of any subobjective contributes to the achievement of its parent objective at the tier above. When it seems plausible that all subobjectives do not provide equal contributions to the objective above them, it is necessary to adjust weights to relate the importance of each's contribution. If, on the other hand, all subobjectives seem to carry equal significance, then weights should be held equivalent for respective organizations.

For the purposes of this research (i.e., in order to retain the most flexibility for XPM resource managers and the RA-IPT participants in utilizing this value model), a fixed weighting scheme will not be established. Rather, weights will be treated as model inputs, and the impacts of different schemes will be evaluated. The determination of model input weights can be performed subjectively by XPM resource managers or RA-IPT members. Guidance from command decision makers about the importance of MEBs, programs, or organizations should provide a foundation for establishing weights. In the case that model users do not have an appropriate feel for model weights, an assessment using revealed preferences can be performed.[11]. The only restriction, imposed by the use of the additive value function, is that the subobjective weights beneath any objective must be positive and sum to one.

Mathematical Value Model

Once the framework of the value model is complete, an associated mathematical function can be established, and an overall value, or score, can be computed for any manpower allocation alternative. The score calculated for any alternative represents the mission effectiveness obtained at the AFMC command level with manpower resources accordingly distributed. Thus, competing strategies, or alternatives, can be compared to determine which provides the highest overall value.

Using an additive value function, overall AFMC value is calculated as a weighted sum of the values at the next tier in the hierarchy, which in turn are calculated as weighted sums of the values at the tiers below them.[12] If explicit representation of all AFMC organizations existed in the value model, the resultant mathematical function would be as shown in Equation (1):

$$U(x_a) = \sum_{m=1}^{5} w_m \cdot \sum_{c=1}^{C_m} w_{mc} \cdot \sum_{t=1}^{T_c} w_{mct} \cdot U_{mct}(x_{amct}) \tag{1}$$

where: a = manpower allocation alternative, $1 \le a \le n$ (n is the number of manpower allocation alternatives generated during the RA-IPT process)

[11] One method of determining relative importance of subobjectives is by revealed preferences. (Refer to Chapter II for a discussion of revealed preferences.) In this context, revealed preferences can be determined by studying the manpower levels currently assigned to each value model organization. The manpower assigned reflects the relative importance of the mission of that organization, and thus the importance of its contribution to the model. Model weights established in this manner are included as part of the complete value model shown in Appendix A.

[12] Refer to Chapter II for a discussion of the additive value function and its underlying assumptions.

w's = weighting factors

m = mission element area, $1 \leq m \leq 5$

c = center, C_m = number of centers with manpower resources in mission element area m

t = two-letter organization, T_c = number of two-letter organizations in center c

$U_{mct}(x_{amct})$ = mission effectiveness value of two-letter organization given the manpower resources allotted by alternative a

This representation must, of course, be modified, since explicit representation of all organizations at Tiers III and IV was deemed unnecessary for the purposes of this research. A more appropriate mathematical function for the value model is presented in Equation (2):

$$U(x_a) = \sum_{m=1}^{5} w_m \cdot \left[\sum_{c=1}^{C_m - 1} w_{mc} \cdot \left[\sum_{t=1}^{T_c - 1} w_{mct} \cdot U_{mct}(x_{amct}) + w_{mcT_c} \cdot U'_{mc}(x_{amc}) \right] + w_{mC_m} \cdot U'_m(x_{am}) \right] \tag{2}$$

where: $U'_m(x_{am})$ = value of combination center, comprised of centers not explicitly modeled at Tier III, given the manpower resources allotted by alternative a

$U'_{mc}(x_{amc})$ = value of combination two-letter organization, comprised of two-letter organizations not explicitly modeled at Tier IV, given the manpower resources allotted by alternative a

A computer spreadsheet application is used to compute the overall value scores, for any manpower allocation alternative.[13]

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[13] Microsoft® Excel, Version 5.0 (10).

V. Results

The objective of this research effort was to develop a methodology that can be used by AFMC/XPM resource managers in comparing the competing manpower allocation strategies developed by the RA-IPT during a resource allocation exercise. Thus, in order to demonstrate the capability of the value model developed, it should be used to compute value scores for manpower allocation strategies for a particular allocation exercise. However, without the specific parameters of a particular exercise at hand, (i.e., without alternatives developed to meet a mandated manpower increase or reduction target,) the model is without a vital input.

Yet, it is possible, using a few example allocation alternatives, to determine how the model will behave. Several strategies can be demonstrated in choosing example manpower levels, providing additional insight into the type of strategies that are most profitable in terms of achieving overall command effectiveness. The following are some applicable strategies:

1. Manpower allocation alternatives are based on organizational mission effectiveness. Each organization is allotted no more than it needs to improve to 100% mission effectiveness (manpower increases) and is reduced by no more than it can give and still function minimally (manpower reductions).

2. Changes in manpower allocations are taken as equal percentages of current manpower levels across all AFMC organizations, regardless of impact on mission effectiveness. This is the aforementioned peanut butter spread methodology.

3. Organizations are allotted manpower based on their importance, reflected by value model weights, or some other subjective ranking system.

The remainder of this chapter focuses on comparing the results of example alternatives generated according to these strategies, thereby assessing their viability in different circumstances. Model sensitivity to input weights is also considered.

Current Manpower Allocation

Important information can always be gained by running the model using currently assigned manpower levels to represent one of the allocation strategies. The model outcome resulting from the current assignment of AFMC manpower provides a measure against which all other strategies should be compared. For instance, if a manpower increase is mandated, the model output values associated with all competing strategies should be higher than the value obtained with the current manpower allocation. The best choice, assuming that maximal AFMC mission effectiveness is always the primary goal, would be the allocation strategy that results in the largest magnitude improvement over the current value. The same philosophy works for a mandated reduction in command manpower; however, instead of looking for the largest gain in value, the best choice would be the alternative resulting in the smallest value score diminishment. Current manpower levels are listed for all Tier IV organizations in Appendix E.

Allocation Based on Mission Effectiveness

Recall that for each Tier IV two-letter, lower and upper bounds exist at the points where the organization effectively breaks or achieves 100% mission effectiveness, respectively. (Lower and upper bound manpower levels are also listed in Appendix E.) Meaningful insight can be gained by running the model on allocation alternatives in which each organization is provided with the manpower level required to function at each of those bounds. Overall value model output scores from these two runs reflect both the overall percentage increase in command manpower needed to raise all organizations to 100% mission effectiveness, and the overall percentage reduction that can be sustained without breaking any organization. Table 5 shows value model scores (using revealed preferences as a basis for weights) for these two allocation alternatives, as well as for the current manpower allocation. The percentage changes from overall current manpower level associated with each are included.

Table 5. Value Model Scores Using Revealed Preference Weights

Manpower Level	Value Model Score	Percentage Change in AFMC Manpower
Upper Bound	100	10.3% Increase
Current	84.65	-----------
Lower Bound	65.3	21.8% Decrease

Similar information can be obtained at any level of the value model hierarchy simply by analyzing the scoring function upper and lower manpower level bounds for the organizations of interest. Since development of a complete manpower allocation alternative to present to decision makers begins with manpower distribution at the MEB level, insight into the requirements of the MEBs should be helpful. Table 6 decomposes the information contained in Table 5 by MEB.

Table 6. Acceptable AFMC Percentage Manpower Changes by MEB

MEB	Increase Required to Reach 100% Mission Effectiveness	Decrease Sustainable to Prohibit Organizational Breakage
PM	1.30	2.42
S&T	0.48	0.92
T&E	0.71	2.95
S&IO	5.26	10.59
BOS	2.53	4.91
TOTAL	10.27	21.79

Figure 4 demonstrates graphically the percentage changes in AFMC manpower that can be sustained by each MEB.

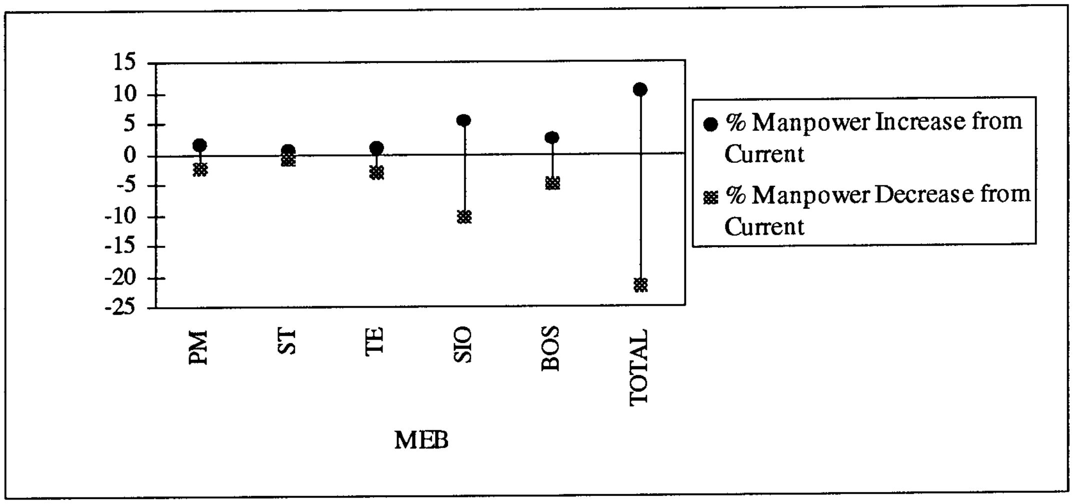

Figure 4. Acceptable AFMC Percentage Manpower Changes by MEB

Allocation Based on Equal Percentages

XPM has successfully performed many previous resource allocation exercises, and although each exercise dealt with different parameters and faced different constraints, some basic strategies were always among those used by the RA-IPT. Among them, one of the most basic is the peanut butter spread, or equal percentage change across all viable AFMC organizations (14).

For this research, model output values were calculated for the following four alternatives and compared against the value obtained for the current allocation of AFMC manpower resources:

1. 5 % increase allocated as a peanut butter spread across all AFMC organizations
2. 5 % decrease allocated as a peanut butter spread across all AFMC organizations
3. 10 % decrease allocated as a peanut butter spread across all AFMC organizations
4. 15 % decrease allocated as a peanut butter spread across all AFMC organizations

The manpower levels associated with each allocation alternative, for all Tier IV organizations, are included in Appendix E. The model output scores, using model weights based on revealed preferences, are plotted, along with the scores generated in the previous section, in Figure 5.

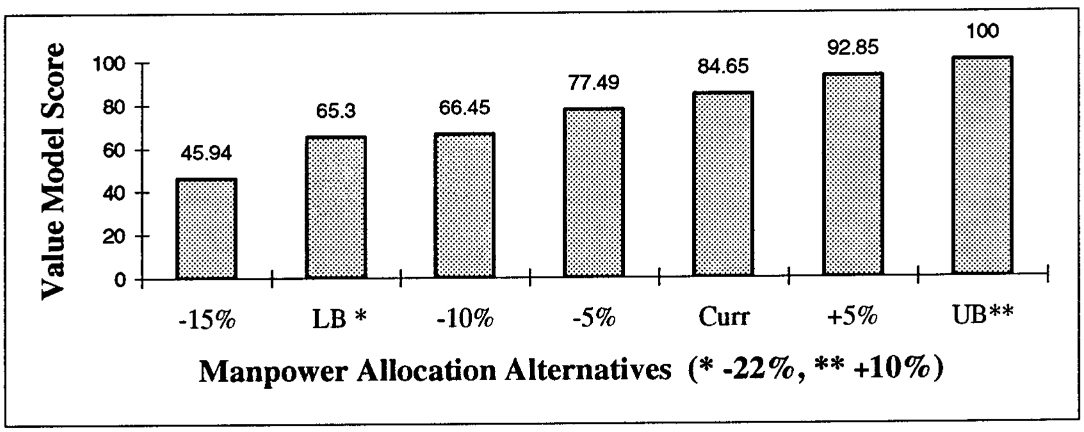

Figure 5. Value Model Scores for Allocation Alternatives

It is immediately obvious from this graph that peanut butter spread cuts do not provide the most efficient use of constrained resources when the goal is the best attainable level of command mission effectiveness. When taking cuts with respect to organizational manpower requirements for achieving mission effectiveness, an overall 21.8% (corresponding to a lower bound alternative) of command resources can be taken without breaking any organizations, resulting in a value score of 65.30. This is comparable damage to mission effectiveness as results from a peanut butter spread of only 10%. A reduction of 15% of command resources, when distributed using a peanut butter spread reduction, results in an even lower value score of 45.94.

In addition, unlike the alternatives produced by evaluating the exact needs of value model organizations, percentage cuts across the command do not ensure that all organizations are able to operate within appropriate mission effectiveness ranges, if at all. Percentage increases may raise the manpower of some organizations beyond levels required to reach 100% mission effectiveness, in effect, wasting manpower that could be more efficiently utilized by other organizations. Similarly, percentage decreases may effectively break some organizations, while barely impacting others. This does not imply that such allocation alternatives are bad by design, as there may be circumstances where it is appropriate to let some organizations suffer to keep others operating at desired levels. Figure 6 shows the percentage of resources belonging to organizations that are no longer able to operate as percentage reductions are taken as peanut butter spreads across AFMC organizations.

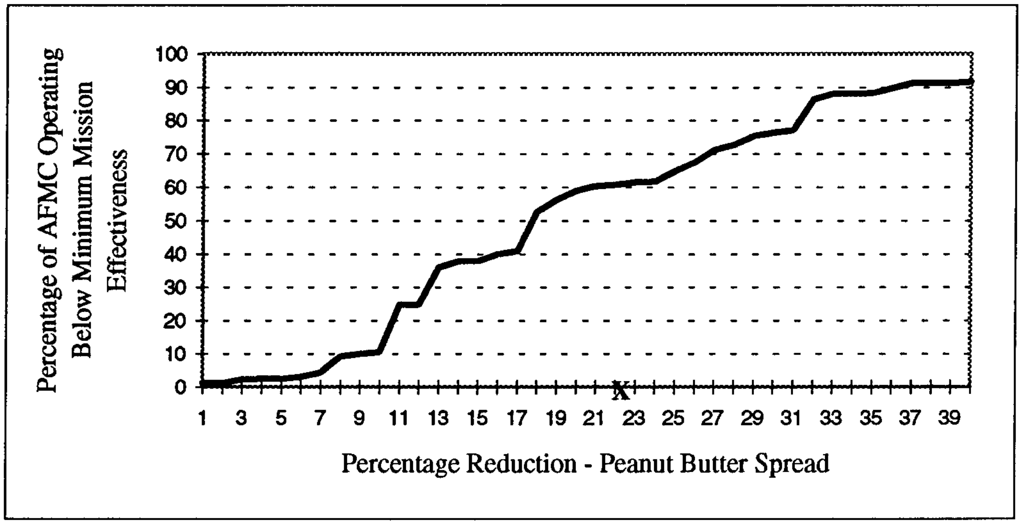

Figure 6. Organizations Broken Per Percentage Manpower Reduction

The X marked on the Figure 6 axis shows the maximum percentage reduction that still enables all command resources to operate, albeit at minimal effectiveness, when allocation is done according to organizational requirements rather than by peanut butter spread. A dramatically higher overall percentage of resources can be lost with reductions taken in accordance with organizational requirements.

Figure 7 shows the percentage of resources belonging to organizations that are able to operate at 100% mission effectiveness as percentage increases are spread across AFMC organizations.

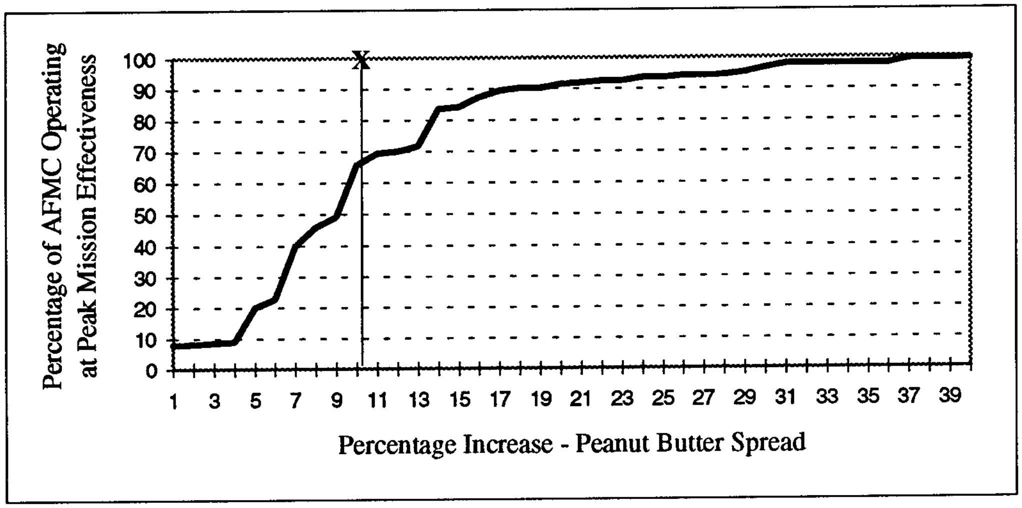

Figure 7. Peak Effectiveness Gained Per Percentage Manpower Increase

The X marked on Figure 7 shows the minimum percentage increase that enables all command resources to operate, at 100% mission effectiveness, when allocation is done according to organizational requirements rather than by peanut butter spread. Note that, in this case, it requires considerably fewer resources to operate at maximal command effectiveness when the requirements of individual organizations are taken into consideration.

Allocation Based on Organizational Importance (Model Weights)

As mentioned previously, there may be times when it is more valuable to AFMC to let the missions of certain (less important) organizations suffer so that other (more important) organizations may retain high levels of mission effectiveness. One feasible allocation alternative that fits this strategy, for manpower reductions, is to cut lowest priority organizations entirely so that others do not have to give up resources. The flip side of this alternative, for manpower increases, is to allocate resources to highest priority organizations first, enabling them to achieve 100% mission effectiveness before allocations are given to organizations with lower priorities.

However, allocation alternatives of this type necessitate that an evaluation of an organization's importance be made in relation to other organizations. Recall that model weights developed using revealed preferences reflect the relative importance of the subobjectives at any model tier. Thus, in effect, they reflect the relative importance of the organizations. Rank ordering two-letters by their overall weights gives a prioritized list of AFMC organizations.

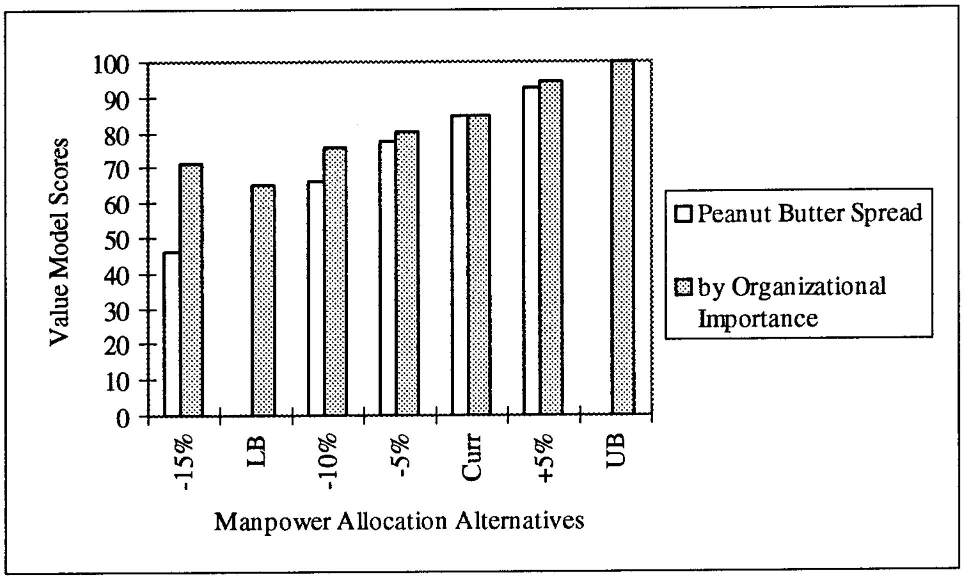

Figure 8. Comparison of Value Model Scores

Figure 8 shows the value scores attained when resources are prioritized by model weights, for the same overall percentage changes used in each of the four peanut butter spread alternatives. Scores for upper and lower bounds are not affected, since in order to reach either bound, manpower levels in every organization in the ranking is impacted to the greatest extent possible. The graph reveals that manpower allocation alternatives generated with respect to organizational importance, as reflected by model weights, outperform peanut butter spread alternatives in achieving higher levels of AFMC mission effectiveness. Of course, deleting entire organizations, regardless of their priority ranking, may not be suitable, even if it does result in high value model scores. Thus, the requirements of the specific resource allocation exercise must still come into play during the alternative generation process.

Model Sensitivity to Input Weights

It is important to get a feel for the impact that different weighting schemes might have on model behavior. Thus far, all value model output scores have been obtained using the revealed preference weights to reflect the relative importance of organizations. Insight can be gained by comparing model output scores using these weights to output scores using equal weights at some or all model tiers. Previous scores obtained for current manpower level, upper and lower manpower bounds, and the four peanut butter spread alternatives are replotted in Figure 9 along with scores generated using equal subobjective weights at all model tiers.

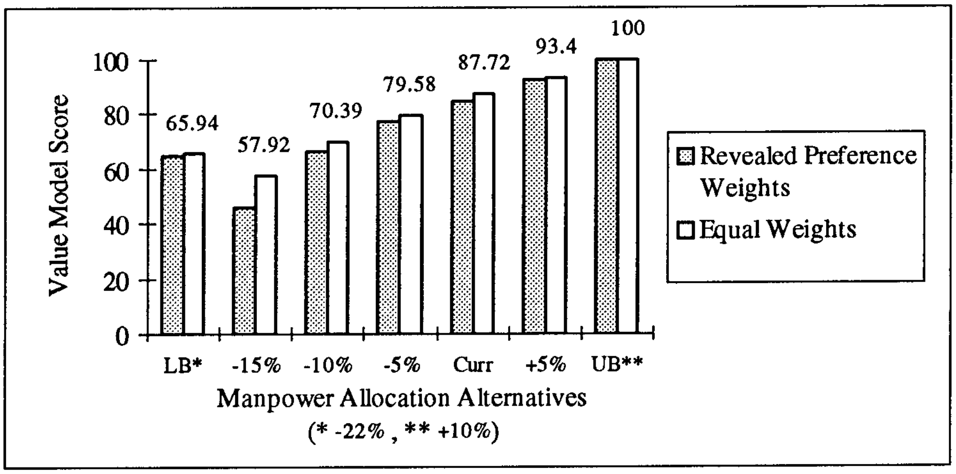

Figure 9. Comparison of Scores Using Different Weighting Schemes

The values at the column tops in Figure 9 are the new scores computed with equal weights. In general, the different weighting schemes do not appear to have a tremendous impact on the magnitudes of the model output values; however, it is important to analyze what is driving the differences. Results like this will be seen when there is a discrepancy in the mission effectiveness levels of high priority versus low priority organizations. High priority organizations with low mission effectiveness levels will have a severe (decreasing) impact on value scores when revealed preference weights are used. When equal weights are substituted, value scores will increase, since those organizations will no longer be weighted as heavily. This is the situation reflected in Figure 9. Conversly, if high priority organizations have high mission effectiveness levels as compared to low priority organizations, value scores using equal weights will be lower than those using revealed preference weights.

VI. Conclusions and Recommendations

This chapter discusses conclusions based on the results of the analysis and makes recommendations for future research.

Conclusions

The objective of this research was to develop a methodology, to be used by AFMC/XPM resource managers during the RA-IPT process to compare potential manpower allocation alternatives; and in doing so, to provide insight into allocation alternatives that might provide better results than fallback peanut butter spread allocation methodologies. It is the conclusion of this research that the value model developed can be successfully used for this purpose.

In addition, although allocation alternatives to meet the parameters and constraints of a particular resource allocation exercise were not studied, it is possible to make some conclusions about general strategies commonly used by XPM in developing particular allocation alternatives. In general, peanut butter spread allocation alternatives do not generate model scores as high as those of alternatives based on organization mission effectiveness (model scoring functions) and organization importance (model weights). However, it is important to remember that the framework of every resource allocation exercise will differ, and it is necessary to develop allocation alternatives for comparison using a strategy that meets the needs of the particular exercise at hand. Once appropriate alternatives have been generated, value model output scores can be compared to judge which alternative provides best overall command value, in terms of mission effectiveness.

Recommendations

The research presented here has provided a value model methodology for comparing competing manpower allocation alternatives during resource allocation exercises. Model behavior for some commonly used allocation techniques has provided insight into general strategies for developing allocation alternatives.

However, there are certainly some areas in which future research could provide model improvements. The following are some areas where further work is potentially beneficial:

1. Explicit model representation of a larger percentage, or all, of the AFMC command resources.

2. Derivation of scoring functions from actual organization data for a larger percentage, or all, of the command.

3. Analysis of the sensitivity of model outputs to the scoring functions used.

4. Determination of a timeline for updating data from AFMC organizations and rederiving scoring functions.

5. Evaluation of techniques for updating the model when AFMC experiences changes in organizational structure.

6. Generation of alternate weighting schemes and further analysis of model sensitivity to input weights.

7. Incorporation of alternative generation methodologies, including possible generation of an optimal allocation alternative.

8. Enhancement of the model's overall score computation spreadsheet into a user-friendly application that allows easy input of model weights and manpower levels for all alternatives of interest.

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
PM MEB				Scoring	Current
0.136				Function	Manpower
	ASC	EN	0.295	1	1856
	0.311	AQ	0.247	2	1551
		AL	0.108	3	680
		PK	0.101	4	635
		FR	0.075	5	473
		SC	0.074	6	465
		RE	0.018	7	111
		FM	0.017	8	109
		OTHER	0.064	9	404
	ESC	FF	0.290	10	1171
	0.200	TE	0.239	11	964
		EN	0.180	12	727
		FM	0.065	13	264
		PK	0.057	14	229
		IM	0.044	15	178
		AL	0.033	16	134
		SC	0.028	17	114
		OTHER	0.063	18	254
	HSC	YA	0.701	19	277
	0.020	PK	0.089	20	35
		FM	0.063	21	25
		SC	0.025	22	10
		OTHER	0.122	23	48
	SMC	ME	0.098	24	601
	0.304	MG	0.092	25	562
		CW	0.081	26	498
		MC	0.076	27	464
		XR	0.072	28	445
		MT	0.069	29	423
		CZ	0.065	30	400
		CE	0.057	31	351
		CL	0.057	32	349
		CY	0.046	33	284
		CU	0.046	34	283
		FM	0.046	35	283
		PK	0.046	36	281
		CI	0.032	37	194
		SD	0.027	38	167
		AL	0.020	39	123
		OTHER	0.071	40	434
	OTHER	OTHER	1.000	41	3326
	0.165				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
S&T MEB				Scoring	Current
0.052				Function	Manpower
	WRIGHT	WD	0.216	42	658
	0.394	WB	0.157	43	477
		WF	0.130	44	395
		WE	0.126	45	384
		WR	0.126	46	384
		WC	0.050	47	153
		DJ	0.044	48	133
		PK	0.041	49	125
		WH	0.031	50	94
		OTHER	0.079	51	239
	ROME	LR	0.317	52	348
	0.142	LO	0.186	53	204
		LA	0.139	54	153
		LK	0.136	55	149
		JX	0.086	56	94
		OTHER	0.137	57	151
	ARMSTRONG	HR	0.242	58	253
	0.135	CF	0.231	59	242
		DO	0.151	60	158
		AO	0.138	61	145
		OE	0.133	62	139
		EQ	0.047	63	49
		XP	0.041	64	43
		OTHER	0.017	65	18
	PHILLIPS	DO	0.241	66	516
	0.277	WS	0.122	67	260
		GP	0.108	68	231
		LI	0.097	69	207
		RK	0.090	70	192
		SX	0.084	71	179
		VT	0.080	72	170
		PK	0.061	73	130
		XP	0.051	74	110
		OTHER	0.067	75	143
	OTHER	OTHER	1.000	76	404
	0.052				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
T&E MEB				Scoring	Current
0.094				Function	Manpower
	AEDC	DO	0.693	77	1771
	0.183	CE	0.205	78	524
		SC	0.050	79	127
		OTHER	0.052	80	134
	AFDTC	TS	0.291	81	1350
	0.333	LG	0.176	82	817
		TG	0.131	83	608
		DO	0.120	84	556
		OG	0.090	85	419
		SC	0.061	86	282
		OS	0.025	87	114
		OTHER	0.107	88	499
	AFFTC	LG	0.336	89	2161
	0.461	TS	0.191	90	1229
		DO	0.078	91	499
		RG	0.070	92	450
		LD	0.037	93	237
		KT	0.033	94	212
		SC	0.016	95	104
		IJ	0.015	96	99
		OS	0.015	97	98
		OTHER	0.208	98	1338
	OTHER	OTHER	1.000	99	315
	0.023				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
S&IO MEB				Scoring	Current
0.453				Function	Manpower
	OC-ALC	LA	0.667	100	12236
	0.273	LI	0.116	101	2126
		LP	0.110	102	2027
		TI	0.054	103	987
		PK	0.014	104	265
		LG	0.014	105	256
		FM	0.012	106	219
		OTHER	0.013	107	236
	OO-ALC	LA	0.302	108	3614
	0.178	LI	0.273	109	3261
		LM	0.206	110	2469
		TI	0.132	111	1580
		LG	0.031	112	367
		PK	0.022	113	264
		FM	0.014	114	162
		OTHER	0.020	115	242
	SA-ALC	LP	0.316	116	3509
	0.165	LA	0.200	117	2226
		LD	0.176	118	1959
		TI	0.107	119	1191
		LG	0.050	120	553
		PK	0.038	121	425
		NW	0.034	122	382
		LT	0.022	123	248
		FM	0.019	124	211
		SF	0.011	125	127
		OTHER	0.025	126	273
	SM-ALC	LA	0.253	127	1920
	0.113	LH	0.252	128	1909
		LI	0.192	129	1458
		TI	0.189	130	1432
		QL	0.024	131	179
		FM	0.022	132	166
		MA	0.020	133	153
		PK	0.018	134	140
		OTHER	0.031	135	233
	WR-ALC	TI	0.171	136	2170
	0.189	LJ	0.155	137	1964
		LB	0.125	138	1590
		LN	0.125	139	1590
		LY	0.113	140	1433
		LF	0.104	141	1320
		LK	0.089	142	1131
		LG	0.032	143	407
		LV	0.025	144	317
		PK	0.022	145	284
		FM	0.016	146	205
		MA	0.009	147	112
		OTHER	0.014	148	181
	OTHER	OTHER	1.000	149	5599
	0.083				

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB				Scoring	Current
0.265				Function	Manpower
	ASC	CE	0.191	150	762
	0.101	LG	0.124	151	494
		SC	0.102	152	406
		SP	0.075	153	301
		DM	0.058	154	231
		SG	0.053	155	211
		SV	0.042	156	168
		FR	0.038	157	152
		PK	0.026	158	105
		MS	0.023	159	91
		OTHER	0.270	160	1079
	ESC	IS	0.149	161	1363
	0.232	LS	0.062	162	569
		EI	0.045	163	407
		SD	0.041	164	372
		OS	0.035	165	324
		LG	0.035	166	321
		CE	0.025	167	226
		OP	0.020	168	185
		ES	0.017	169	159
		PK	0.015	170	135
		SC	0.014	171	124
		DP	0.013	172	121
		SV	0.013	173	121
		PG	0.011	174	104
		SP	0.011	175	96
		OTHER	0.493	176	4504
	HSC	CE	0.121	177	164
	0.034	AO	0.110	178	149
		OE	0.103	179	139
		LG	0.092	180	125
		DP	0.084	181	113
		SC	0.081	182	110
		SV	0.078	183	106
		SP	0.049	184	66
		OTHER	0.281	185	380

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB				Scoring	Current
(cont)				Function	Manpower
	SMC	CE	0.154	186	468
	0.077	SC	0.148	187	450
		LG	0.136	188	413
		SP	0.123	189	375
		CM	0.067	190	203
		MW	0.047	191	142
		MS	0.044	192	135
		FM	0.043	193	130
		DP	0.036	194	108
		OTHER	0.203	195	616
	OC-ALC	LG	0.178	196	505
	0.072	CE	0.172	197	487
		SC	0.121	198	343
		SP	0.106	199	301
		DP	0.096	200	273
		SV	0.064	201	181
		FM	0.040	202	113
		EM	0.035	203	100
		PK	0.034	204	95
		OS	0.031	205	87
		OTHER	0.123	206	349
	00-ALC	CE	0.301	207	841
	0.071	LG	0.172	208	479
		SC	0.087	209	244
		DP	0.072	210	202
		SP	0.060	211	168
		SV	0.048	212	133
		OS	0.034	213	95
		MA	0.039	214	110
		OTHER	0.187	215	521
	SA-ALC	CE	0.265	216	769
	0.074	LG	0.151	217	437
		DP	0.115	218	334
		SC	0.098	219	283
		SP	0.065	220	189
		SV	0.053	221	153
		FM	0.036	222	104
		OS	0.031	223	89
		OTHER	0.186	224	540

Appendix A. AFMC Value Model

AFMC VALUE MODEL					
Hierarchy with weights established based on revealed preferences					
OVERALL OBJECTIVE: AFMC Mission Effectiveness					
BOS MEB (cont)				Scoring Function	Current Manpower
	SM-ALC	CE	0.254	225	627
	0.063	SC	0.181	226	446
		LG	0.099	227	245
		DP	0.086	228	212
		SP	0.064	229	157
		SV	0.056	230	139
		EM	0.044	231	108
		OTHER	0.215	232	531
	WR-ALC	CE	0.211	233	485
	0.058	LG	0.133	234	305
		DP	0.114	235	263
		SC	0.101	236	232
		SP	0.096	237	221
		SV	0.056	238	129
		SG	0.017	239	40
		OTHER	0.272	240	626
	AEDC	CE	0.471	241	588
	0.032	MY	0.105	242	131
		SC	0.078	243	97
		DP	0.070	244	87
		PK	0.066	245	83
		SP	0.053	246	66
		FM	0.046	247	58
		OTHER	0.111	248	139
	AFDTC	LG	0.225	249	752
	0.085	CE	0.221	250	739
		SP	0.077	251	259
		SC	0.073	252	245
		SV	0.063	253	212
		TS	0.059	254	196
		OS	0.057	255	192
		SG	0.040	256	135
		MS	0.022	257	75
		PK	0.019	258	63
		OTHER	0.143	259	480
	AFFTC	CE	0.310	260	861
	0.070	LG	0.149	261	414
		SP	0.146	262	404
		SC	0.075	263	207
		SV	0.062	264	173
		DP	0.059	265	165
		OS	0.018	266	50
		OTHER	0.181	267	502
	OTHER	OTHER	1.000	268	1233
	0.031				

Appendix B: Mission Effectiveness Survey

N O T I O N A L   D A T A

CENTER:________ 2-LTR: ________

Please answer the following questions concerning the relationship between manpower resources and mission effectiveness in your organization.

1. Your authorized manning level is _______ as of end FY951.

2. What manning increase/decrease (circle one) would optimally size your organization to achieve 100% mission effectiveness? _______ authorizations.
(An entry of zero indicates you are at 100% mission effectiveness with current manning.)

3. If organizational performance at the optimal level is considered 100% mission effectiveness, what percentage level would you say you are attaining with your current manning? _______ %.

4. Below what percentage effectiveness level would your organization critically and terminally fail? _______ % effectiveness / _______ total authorizations remaining.

Comments:

N O T I O N A L   D A T A

Thank you for taking the time to complete this survey

Appendix C. Mission Effectiveness Survey Results

AEDC:

CE	Manpower	Effectiveness
	59	100
	46	75
	40	65

DO	Manpower	Effectiveness
	1767	100
	1767	100
	1414	80

DP	Manpower	Effectiveness
	97	100
	87	80
	52	60

FM	Manpower	Effectiveness
	89	100
	87	95
	81	90

MY	Manpower	Effectiveness
	131	100
	131	100
	105	80

PK	Manpower	Effectiveness
	138	100
	138	100
	110	80

SC	Manpower	Effectiveness
	241	100
	224	80
	197	80

AAS/SP	Manpower	Effectiveness
	3	100
	2	50
	2	50

AFDTC: No Data Collected

Appendix C. Mission Effectiveness Survey Results

AFFTC:

CE

Manpower	Effectiveness
841	100
719	76
596	70

DO

Manpower	Effectiveness
455	100
455	100
0	0

DP

Manpower	Effectiveness
97	100
87	80
52	60

JJ

Manpower	Effectiveness
160	100
145	71
88	55

LD/LG

Manpower	Effectiveness
2700	100
2495	92
2300	85

OS

Manpower	Effectiveness
168	100
154	85
0	0

RG

Manpower	Effectiveness
224	100
224	92
168	75

SC

Manpower	Effectiveness
350	100
275	60
275	60

SP

Manpower	Effectiveness
224	100
234	100
135	

SV

Manpower	Effectiveness
110	100
105	90
5	10

TS

Manpower	Effectiveness
1053	100
934	87
0	0

Appendix C. Mission Effectiveness Survey Results

AFMUSEUM: No Data Collected

AFSAC: No Data Collected

AGMC:

		Manpower	Effectiveness
	ML	153	100
		128	72
		0	0

AMARC: No Data Collected

ASC:

		Manpower	Effectiveness
	AL	757	100
		711	94
		651	86

		Manpower	Effectiveness
	AQ	1784	100
		1784	100
		1338	75

		Manpower	Effectiveness
	EN	2447	100
		2234	93
		1837	80

		Manpower	Effectiveness
	PK	1128	100
		1054	93
		1023	90

		Manpower	Effectiveness
	RE	220	100
		212	95
		0	0

CASC: No Data Collected

ESC: No Data Collected

Appendix C. Mission Effectiveness Survey Results

FOA: No Data Collected

HQAFMC: Not Included in Research

HSC:

MO	Manpower	Effectiveness
	11	100
	10	70
	5	50

JLSC: No Data Collected

OC-ALC:

CE	Manpower	Effectiveness
	985	100
	885	85
	420	60

OS	Manpower	Effectiveness
	90	100
	87	95
	84	90

DP	Manpower	Effectiveness
	295	100
	295	100
	221	75

PK	Manpower	Effectiveness
	515	100
	365	72
	315	60

EM	Manpower	Effectiveness
	141	100
	126	90
	66	75

SC	Manpower	Effectiveness
	399	100
	351	88
	264	66

FM	Manpower	Effectiveness
	382	100
	332	85
	267	30

SP	Manpower	Effectiveness
	329	100
	289	90
	230	80

LG	Manpower	Effectiveness
	841	100
	761	85
	380	70

SV	Manpower	Effectiveness
	180	100
	160	88
	140	60

LI	Manpower	Effectiveness
	2760	100
	2126	76
	1435	61

TI	Manpower	Effectiveness
	1124	100
	988	84
	721	75

LP	Manpower	Effectiveness
	2760	100
	2026	75
	1450	60

Appendix C. Mission Effectiveness Survey Results

OO-ALC: No Data Collected

SA-ALC:

CE

Manpower	Effectiveness
997	100
834	79
683	60

PK

Manpower	Effectiveness
582	100
488	83
310	53

DP

Manpower	Effectiveness
326	100
238	62
138	60

SC

Manpower	Effectiveness
303	100
241	80
227	75

LD

Manpower	Effectiveness
2156	100
1960	90
1470	75

SE

Manpower	Effectiveness
178	100
153	86
0	0

LG

Manpower	Effectiveness
1210	100
1032	83
577	55

SP

Manpower	Effectiveness
247	100
243	98
210	85

LP

Manpower	Effectiveness
3855	100
3505	90
2103	60

SV

Manpower	Effectiveness
164	100
128	84
98	55

LT

Manpower	Effectiveness
574	100
545	95
344	60

TI

Manpower	Effectiveness
1322	100
1191	90
860	65

NW

Manpower	Effectiveness
492	100
457	93
0	0

OS

Manpower	Effectiveness
92	100
90	98
78	85

Appendix C. Mission Effectiveness Survey Results

SM-ALC:

Office	Manpower	Effectiveness
CE	983	100
	858	85
	600	70
DP	197	100
	158	80
	148	75
EM	316	100
	286	90
	269	85
FM	286	100
	228	66
	59	50
LA	2033	100
	1903	60
	200	50
LG	371	100
	323	87
	291	78
LH	2191	100
	1880	86
	1045	50
LI	1428	100
	1428	100
	900	40
MA	226	100
	206	90
	185	90
PK	257	100
	217	75
	200	70
QL	420	100
	357	85
	336	80
SC	496	100
	456	85
	425	75
SP	182	100
	164	90
	102	33
SV	150	100
	142	90
	71	50
TI	1744	100
	1408	81
	986	70

Appendix C. Mission Effectiveness Survey Results

SMC:		Manpower	Effectiveness		Manpower	Effectiveness
	AL	153	100	ME	575	100
		145	95		543	95
		115	75		403	70
	CE	613	100	MG	568	100
		613	100		568	100
		490	80		426	75
	CI	256	100	MT	775	100
		196	75		435	56
		180	70		388	50
	CL	350	100	MW	65	100
		334	95		65	100
		245	70		48	75
	CU	416	100	PK	340	100
		376	85		323	95
		312	75		272	80
	CW	626	100	SC	272	100
		543	86		259	95
		489	78		204	75
	CZ	441	100	SD	183	100
		404	91		174	95
		375	85		137	75
	DP	95	100	SP	159	100
		119	125		159	100
		95	100		127	80
	FM	363	100	XR	487	100
		345	95		464	95
		290	80		390	80

Appendix C. Mission Effectiveness Survey Results

WR-ALC:

	Manpower	Effectiveness
	719	100
	593	82
	593	82

	Manpower	Effectiveness
	1480	100
	1460	95
	1400	90

DP	Manpower	Effectiveness
	240	100
	224	90
	190	80

LV	Manpower	Effectiveness
	368	100
	328	89
	23	25

FM	Manpower	Effectiveness
	304	100
	284	93
	240	75

LY	Manpower	Effectiveness
	1820	100
	1400	70
	1300	65

LB	Manpower	Effectiveness
	1610	100
	1603	95
	1350	85

MA	Manpower	Effectiveness
	115	100
	112	98
	108	95

LF	Manpower	Effectiveness
	1350	100
	1337	95
	1250	90

PK	Manpower	Effectiveness
	406	100
	396	95
	375	90

LG	Manpower	Effectiveness
	100	100
	743	100
	615	83

SC	Manpower	Effectiveness
	239	100
	190	79
	120	50

LJ	Manpower	Effectiveness
	2106	100
	1986	92
	1830	85

SG	Manpower	Effectiveness
	507	100
	458	94
	458	94

LK	Manpower	Effectiveness
	1232	100
	1157	85
	1125	80

SP	Manpower	Effectiveness
	224	100
	224	100
	180	80

LN	Manpower	Effectiveness
	1735	100
	1623	65
	1400	60

SV	Manpower	Effectiveness
	134	100
	116	81
	87	65

LR	Manpower	Effectiveness
	286	100
	228	80
	198	70

TI	Manpower	Effectiveness
	2439	100
	2277	92
	1480	65

Appendix D. Scoring Function Coefficients and Bounds

Coefficients of Polynomial Scoring Functions

Scoring Function	MEB	Subcommand	Two-letter	Lower Bound	X^4th	X^3rd	X^2nd	X	Constant	Upper Bound
1	PM	ASC	EN	1526	-1.59E-12	1.15E-08	-3.09E-05	0.0758	3.96	2033
2	PM	ASC	AQ	1163	0	0.00E+00	0	0.0644	0.0644	1551
3	PM	ASC	AL	623	5.17E-09	-1.40E-05	0.0141	-6.184	1057	724
7	PM	ASC	RE	0	-3.82E-07	1.22E-04	-0.0095	0.9301	0	115
8	PM	ASC	FM	92	5.51E-06	-0.00233	0.367	-24.62	658.7	115
10	PM	ESC	FF	961	3.56E-10	-1.63E-06	0.0028	-1.951	547.3	1281
11	PM	ESC	TE	791	7.28E-10	-2.74E-06	0.00381	-2.218	512.8	1054
12	PM	ESC	EN	596	2.17E-09	-6.15E-06	0.00645	-2.828	493.6	795
13	PM	ESC	FM	217	1.60E-07	-0.00016	0.0628	-10.11	637.6	289
14	PM	ESC	PK	188	1.97E-07	-0.00018	0.0582	-7.98	439.7	250
15	PM	ESC	IM	146	7.37E-07	-0.00051	0.1315	-14.25	606.5	195
16	PM	ESC	AL	110	2.64E-06	-0.00138	0.2675	-21.94	701.8	147
17	PM	ESC	SC	94	5.96E-06	-0.00265	0.4375	-30.74	834.6	125
18	PM	ESC	OTHER	208	1.50E-07	-0.00015	0.0543	-8.317	507.1	278
19	PM	HSC	YA	227	1.04E-07	-0.00011	0.0449	-7.495	498.4	303
20	PM	HSC	PK	29	3.09E-04	-0.04213	2.131	-44.26	372.1	38
21	PM	HSC	FM	21	1.56E-03	-0.1526	5.533	-83.58	496.7	27
22	PM	HSC	SC	8	2.50E-02	-0.9708	13.91	-77.84	199	11
23	PM	HSC	OTHER	39	1.53E-04	-0.0286	1.978	-57.9	664.5	53
24	PM	SMC	ME	446	3.75E-09	-8.49E-06	0.00707	-2.411	343.4	636
25	PM	SMC	MG	422	0	0	0	0.1786	-0.357	562
26	PM	SMC	CW	448	-1.62E-08	3.28E-05	-0.02461	8.294	-993.9	574
27	PM	SMC	MC	422	-7.34E-09	1.41E-05	-0.01003	3.295	-357.4	563
28	PM	SMC	XR	374	-2.74E-08	4.72E-05	-0.03023	8.762	-899.8	467
29	PM	SMC	MT	377	-6.63E-11	1.34E-07	-9.24E-05	0.1569	-1.87	754
31	PM	SMC	CE	281	0	0	0	0.2857	-0.286	351
32	PM	SMC	CL	256	-2.68E-08	3.50E-05	-0.01683	3.802	-272.6	366
33	PM	SMC	CY	236	-1.23E-08	1.38E-05	-0.00571	1.329	-63.74	321
35	PM	SMC	FM	238	1.90E-18	-2.22E-16	5.68E-14	0.3333	0.6667	298
36	PM	SMC	PK	237	5.05E-08	-0.00006	0.02235	-3.658	265.8	296
37	PM	SMC	CI	178	-3.65E-07	0.00030	-0.09133	12.39	-575.7	253
38	PM	SMC	SD	131	-3.47E-18	2.67E-15	-4.55E-13	0.5556	2.222	176
39	PM	SMC	AL	98	3.62E-06	-0.00170	0.297	-21.96	644	130
40	PM	SMC	OTHER	361	-7.31E-10	1.25E-06	-0.00080	0.413	-17.02	491
41	PM	OTHER	OTHER	2729	5.35E-12	-6.94E-08	0.00033	-0.6703	534.3	3638
42	S&T	WRIGHT	WD	540	3.66E-09	-9.41E-06	0.00893	-3.566	561.9	720
43	S&T	WRIGHT	WB	391	1.26E-08	-2.34E-05	0.01607	-4.636	530.3	522
44	S&T	WRIGHT	WF	324	2.61E-08	-4.02E-05	0.02289	-5.464	517.7	432
45	S&T	WRIGHT	WE	315	2.95E-08	-4.42E-05	0.02451	-5.691	524	420
46	S&T	WRIGHT	WR	315	2.95E-08	-4.42E-05	0.02451	-5.691	524	420
47	S&T	WRIGHT	WC	126	1.19E-06	-0.00071	0.157	-14.54	532.8	167
48	S&T	WRIGHT	DJ	109	1.21E-06	-0.00062	0.1197	-9.294	300.9	145
50	S&T	WRIGHT	WH	77	9.02E-06	-0.00331	0.4486	-25.6	576.3	103

Appendix D. Scoring Function Coefficients and Bounds

51	S&T	WRIGHT	OTHER		196	1.61E-07	-0.00015	0.0517	-7.386	425.2	261
52	S&T	ROME	LR		285	4.40E-08	-5.97E-05	0.02996	-6.303	526.1	381
53	S&T	ROME	LO		167	3.06E-07	-0.00024	0.07154	-8.728	429.1	223
54	S&T	ROME	LA		126	1.19E-06	-0.00071	0.157	-14.54	532.8	167
55	S&T	ROME	LK		122	1.19E-06	-0.00069	0.1486	-13.32	477.1	163
56	S&T	ROME	JX		77	9.02E-06	-0.0033	0.4486	-25.6	576.3	103
57	S&T	ROME	OTHER		124	1.19E-06	-0.0007	0.1528	-13.92	504.3	165
58	S&T	ARMSTRONG	HR		208	1.94E-07	-0.00019	0.06989	-10.8	652.5	277
59	S&T	ARMSTRONG	CF		199	2.37E-07	-0.00022	0.07824	-11.57	668.7	265
60	S&T	ARMSTRONG	DO		130	1.33E-06	-0.00082	0.1875	-18.12	683.4	173
62	S&T	ARMSTRONG	OE		114	1.66E-06	-0.00090	0.1808	-15.17	506	152
63	S&T	ARMSTRONG	EQ		40	1.53E-04	-0.0292	2.064	-61.95	724.4	54
64	S&T	ARMSTRONG	XP		35	9.77E-05	-0.01634	1.011	-25.1	265.6	47
66	S&T	PHILLIPS	DO		423	8.08E-09	-1.63E-05	0.0121	-3.753	465.5	564
67	S&T	PHILLIPS	WS		213	1.10E-07	-0.00011	0.04189	-6.494	407.4	284
68	S&T	PHILLIPS	GP		190	2.93E-07	-0.00026	0.08809	-12.45	686.4	253
69	S&T	PHILLIPS	LI		170	3.06E-07	-0.00025	0.07375	-9.164	456	226
70	S&T	PHILLIPS	RK		158	5.64E-07	-0.00042	0.1172	-13.72	629.3	210
71	S&T	PHILLIPS	SX		147	7.37E-07	-0.00051	0.133	-14.51	620.9	196
72	S&T	PHILLIPS	VT		139	6.55E-07	-0.00043	0.1063	-10.83	443.5	186
73	S&T	PHILLIPS	PK		109	-2.43E-17	8.88E-16	2.27E-13	0.7143	2.143	137
74	S&T	PHILLIPS	XP		90	2.50E-06	-0.00107	0.1697	-10.87	291.7	120
75	S&T	PHILLIPS	OTHER		117	8.75E-07	-0.00049	0.1004	-8.36	291.8	156
76	S&T	OTHER	OTHER		331	2.31E-08	-3.64E-05	0.02121	-5.168	501.2	442
77	T&E	AEDC	DO		1417	0	0	0	0.0565	-0.057	1771
78	T&E	AEDC	CE		456	-2.94E-09	6.43E-06	-0.00514	1.936	-231.3	672
81	T&E	AFDTC	TS		994	-9.64E-10	4.91E-06	-0.00919	7.588	-2290	1447
82	T&E	AFDTC	LG		601	-7.06E-09	2.18E-05	-0.02465	12.31	-2247	876
83	T&E	AFDTC	TG		448	-2.30E-08	5.27E-05	-0.04445	16.53	-2248	652
85	T&E	AFDTC	OG		308	-1.05E-07	0.00017	-0.09596	24.56	-2298	449
86	T&E	AFDTC	SC		208	-5.29E-07	0.00056	-0.2204	38	-2398	302
88	T&E	AFDTC	OTHER		367	-5.08E-08	9.58E-05	-0.06623	20.2	-2252	535
89	T&E	AFFTC	LG		1992	-1.13E-10	9.73E-07	-0.00315	4.541	-2402	2339
90	T&E	AFFTC	TS		0	-6.44E-12	2.36E-08	-2.00E-05	0.07167	0	1386
91	T&E	AFFTC	DO		0	0	0	0	0.2004	0	499
92	T&E	AFFTC	RG		338	0	0	0	0.2232	-0.446	450
94	T&E	AFFTC	KT		152	-3.42E-07	0.00027	-0.08006	10.82	-529.1	231
95	T&E	AFFTC	SC		104	0	0	0	1.429	-88.57	132
97	T&E	AFFTC	OS		0	-9.42E-07	0.00027	-0.01848	0.9571	0	107
98	T&E	AFFTC	OTHER		957	-2.45E-10	1.24E-06	-0.00228	1.926	-590	1456
99	T&E	OTHER	OTHER		232	-3.10E-07	0.00037	-0.1609	31.01	-2184	338
101	S&IO	OC-ALC	LI		1435	-9.26E-12	7.81E-08	-0.00023	0.3086	-97.95	2760
102	S&IO	OC-ALC	LP		1451	-4.76E-12	3.95E-08	-0.00011	0.1661	-39.21	2761
103	S&IO	OC-ALC	TI		720	-1.73E-09	6.57E-06	-0.00906	5.447	-1134	1123
104	S&IO	OC-ALC	PK		229	3.44E-08	-0.00004	0.01619	-2.528	168.1	374
106	S&IO	OC-ALC	FM		176	2.51E-06	-0.00217	0.6885	-94.11	4684	252
107	S&IO	OC-ALC	OTHER		163	-1.29E-08	1.20E-05	-0.00397	0.8418	-15.78	300
109	S&IO	OO-ALC	LI		2244	-5.26E-12	6.51E-08	-0.00029	0.5806	-379.3	3696

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110	S&IO	OO-ALC	LM		1699	-1.61E-11	1.51E-07	-0.00051	0.7698	-380.9	2798
111	S&IO	OO-ALC	TI		1087	-9.51E-11	5.70E-07	-0.00123	1.193	-377.4	1791
112	S&IO	OO-ALC	LG		253	-3.27E-08	4.55E-05	-0.0229	5.155	-379.6	416
113	S&IO	OO-ALC	PK		182	-1.26E-07	0.00013	-0.04546	7.353	-390.2	299
114	S&IO	OO-ALC	FM		109	-6.07E-07	0.00037	-0.08244	8.333	-274.6	187
115	S&IO	OO-ALC	OTHER		167	-1.80E-07	0.00016	-0.05469	8.109	-395.1	274
116	S&IO	SA-ALC	LP		2105	-1.85E-12	2.38E-08	-0.00011	0.2307	-130.8	3859
118	S&IO	SA-ALC	LD		1469	-8.60E-11	6.45E-07	-0.00177	2.149	-903.6	2155
119	S&IO	SA-ALC	TI		860	-1.12E-11	5.05E-08	-8.34E-05	0.1352	-15.64	1322
120	S&IO	SA-ALC	LG		309	-2.25E-09	4.58E-06	-0.00324	1.065	-79.41	648
121	S&IO	SA-ALC	PK		270	-1.39E-09	2.25E-06	-0.00129	0.503	-26.07	507
122	S&IO	SA-ALC	NW		0	4.34E-11	-4.85E-08	0.00001	0.2432	0	411
123	S&IO	SA-ALC	LT		157	-1.19E-18	3.33E-16	-7.11E-15	0.3846	-0.385	261
124	S&IO	SA-ALC	FM		142	-2.28E-07	0.00018	-0.05248	6.876	-296.1	243
125	S&IO	SA-ALC	SF		0	4.58E-09	-1.8E-06	0.00015	0.6768	0	148
126	S&IO	SA-ALC	OTHER		166	1.89E-08	-1.90E-05	0.006769	-0.6228	35.23	303
129	S&IO	SM-ALC	LI		919	0	0	0	0.1113	-62.3	1458
130	S&IO	SM-ALC	TI		1003	-8.72E-11	4.90E-07	-0.00098	0.8643	-214.8	1774
131	S&IO	SM-ALC	QL		168	-2.45E-07	0.00018	-0.04986	6.505	-269.8	211
133	S&IO	SM-ALC	MA		137	-1.87E-06	0.00114	-0.2592	26.67	-981.2	168
136	S&IO	WR-ALC	TI		1410	-3.02E-11	2.40E-07	-0.00069	0.8954	-373.7	2324
137	S&IO	WR-ALC	LJ		1810	-1.43E-09	1.12E-05	-0.03263	42.28	-20440	2083
140	S&IO	WR-ALC	LY		1331	-1.92E-10	1.17E-06	-0.00264	2.637	-939.9	1863
143	S&IO	WR-ALC	LG		407	0	0	0	0.2	1.6	492
144	S&IO	WR-ALC	LV		22	-2.49E-09	2.42E-06	-0.00060	0.2443	19.89	356
149	S&IO	OTHER	OTHER		3853	-6.05E-13	1.29E-08	-9.85E-05	0.338	-379.1	6346
158	BOS	ASC	PK		102	-3.09E-15	7.71E-13	-4.28E-11	1	-12	112
186	BOS	SMC	CE		374	0	0	0	0.2128	0.426	468
187	BOS	SMC	SC		354	-7.48E-09	1.28E-05	-0.00814	2.478	-233.4	473
189	BOS	SMC	SP		300	0	0	0	0.2667	0	375
191	BOS	SMC	MW		105	0	0	0	0.6757	4.054	142
193	BOS	SMC	FM		109	-2.43E-17	8.88E-16	2.27E-13	0.7143	2.143	137
194	BOS	SMC	DP		0	0	0	0	1.163	0	86
197	BOS	OC-ALC	CE		231	-8.14E-09	1.39E-05	-0.00817	2.041	-124.3	542
198	BOS	OC-ALC	SC		258	2.05E-09	-2.72E-06	0.00132	-0.0189	20.7	390
199	BOS	OC-ALC	SP		240	-9.08E-08	0.00011	-0.04661	9	-577.7	343
200	BOS	OC-ALC	DP		205	0	0	0	0.3676	-0.368	273
203	BOS	OC-ALC	EM		52	-3.35E-06	0.00120	-0.1489	7.94	-79.45	112
204	BOS	OC-ALC	PK		82	2.00E-06	-0.00082	0.1209	-6.729	161	134
205	BOS	OC-ALC	OS		84	-8.66E-15	5.68E-13	-2.18E-11	1.667	-50	90
206	BOS	OC-ALC	OTHER		228	-2.16E-08	2.83E-05	-0.01328	2.836	-166	397
207	BOS	00-ALC	CE		638	-9.08E-10	2.98E-06	-0.00356	1.929	-336	970
208	BOS	00-ALC	LG		363	-8.33E-09	1.56E-05	-0.01059	3.274	-323.4	553
209	BOS	00-ALC	SC		185	-1.18E-07	0.00011	-0.03892	6.144	-307.9	282
210	BOS	00-ALC	DP		153	-2.74E-07	0.00022	-0.06192	8.055	-336.5	233
211	BOS	00-ALC	SP		127	-5.52E-07	0.00036	-0.0862	9.332	-322.4	194
212	BOS	00-ALC	SV		101	-1.61E-06	0.00083	-0.1576	13.46	-374.5	153
213	BOS	00-ALC	OS		72	-4.74E-06	0.0018	-0.2375	14.65	-283.5	110

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214	BOS	00-ALC	MA		83	-3.05E-06	0.00131	-0.2041	14.44	-326.5	127
215	BOS	00-ALC	OTHER		395	-6.15E-09	1.25E-05	-0.00924	3.104	-334.5	601
216	BOS	SA-ALC	CE		630	-1.83E-10	5.65E-07	-0.00064	0.4515	-83.32	919
217	BOS	SA-ALC	LG		244	-5.78E-09	9.30E-06	-0.00520	1.351	-79.53	512
219	BOS	SA-ALC	SC		267	7.64E-08	-0.00009	0.04052	-7.563	559.6	356
221	BOS	SA-ALC	SV		117	1.17E-06	-0.00073	0.1619	-14.64	497.1	196
222	BOS	SA-ALC	FM		70	-3.62E-06	0.00143	-0.2028	13.15	-278.5	120
224	BOS	SA-ALC	OTHER		387	-5.35E-09	1.12E-05	-0.00851	2.863	-297.3	643
227	BOS	SM-ALC	LG		221	8.61E-08	-0.00009	0.0316	-4.764	306.2	281
228	BOS	SM-ALC	DP		199	-6.78E-21	3.02E-16	-6.40E-14	0.3846	-1.538	264
229	BOS	SM-ALC	SP		98	1.19E-06	-0.00069	0.1425	-11.6	338.9	174
230	BOS	SM-ALC	SV		70	-2.10E-06	0.00102	-0.1729	12.74	-293.7	147
232	BOS	SM-ALC	OTHER		424	-3.66E-10	7.62E-07	-0.00058	0.3817	-36.31	600
233	BOS	WR-ALC	CE		485	0	0	0	0.1748	-2.757	588
234	BOS	WR-ALC	LG		305	0	0	0	0.2698	0.698	368
236	BOS	WR-ALC	SC		147	-3.87E-09	3.48E-06	-0.00109	0.4844	-6.862	292
237	BOS	WR-ALC	SP		178	0	0	0	0.4651	-2.791	221
238	BOS	WR-ALC	SV		97	-4.29E-06	0.00216	-0.394	31.73	-891.6	149
239	BOS	WR-ALC	SG		40	0	0	0	1.5	34	44
241	BOS	AEDC	CE		511	-1.96E-09	4.80E-06	-0.00431	1.81	-242.8	754
242	BOS	AEDC	MY		105	0	0	0	0.7692	-0.769	131
244	BOS	AEDC	DP		52	-2.17E-05	0.00690	-0.7811	37.94	-612.9	97
245	BOS	AEDC	PK		66	0	0	0	1.176	2.353	83
246	BOS	AEDC	SP		66	0	0	0	1.515	-50	99
249	BOS	AFDTC	LG		621	-1.03E-08	3.03E-05	-0.03294	15.92	-2838	825
250	BOS	AFDTC	CE		610	-1.09E-08	3.14E-05	-0.03357	15.94	-2793	811
256	BOS	AFDTC	SG		111	-1.04E-05	0.00548	-1.069	92.51	-2952	148
260	BOS	AFFTC	CE		714	-6.55E-09	2.26E-05	-0.02855	15.84	-3190	1007
262	BOS	AFFTC	SP		233	0	0	0	0.2597	-0.520	387
263	BOS	AFFTC	SC		207	0	0	0	0.7143	-87.86	263
264	BOS	AFFTC	SV		8	-2.17E-07	0.00011	-0.01451	0.826	4.265	181
265	BOS	AFFTC	DP		99	-1.69E-06	0.00102	-0.2192	20.23	-621.8	184
266	BOS	AFFTC	OS		0	-1.13E-05	0.00166	-0.05754	1.834	0	55
268	BOS	OTHER	OTHER		960	-2.98E-10	1.43E-06	-0.00253	2.01	-550.1	1402

Appendix D. Scoring Function Coefficients and Bounds

Coefficients of Piecewise Linear Scoring Functions

Scoring Function	MEB	Subcommand	Two-letter	Lower Bound	Slope	Intercept	Middle Bound	Slope	Intercept	Upper Bound
4	PM	ASC	PK	616	0.1579	-7.263	635	0.1556	-5.778	680
5	PM	ASC	FR	382	0.3165	-54.7	473	0.1852	7.407	500
6	PM	ASC	SC	376	0.3236	-55.47	465	0.1923	5.577	491
9	PM	ASC	OTHER	326	0.3692	-54.17	404	0.2174	7.174	427
30	PM	SMC	CZ	371	0.2069	8.241	400	0.2432	-6.297	437
34	PM	SMC	CU	235	0.2083	26.04	283	0.5	-56.5	313
49	S&T	WRIGHT	PK	121	0.75	-0.75	125	0.7778	-4.222	134
61	S&T	ARMSTRONG	AO	119	0.7308	-14.96	145	0.6429	-2.214	159
65	S&T	ARMSTRONG	OTHER	15	6.333	-23	18	4.5	10	20
79	T&E	AEDC	SC	112	0.6667	-4.667	127	2	-174	137
80	T&E	AEDC	OTHER	109	0.4	31.4	134	7.5	-920	136
84	T&E	AFDTC	DO	409	0.2177	-36.03	556	0.375	-123.5	596
87	T&E	AFDTC	OS	84	1.067	-36.6	114	1.875	-128.8	122
93	T&E	AFFTC	LD	218	0.3684	4.684	237	0.4211	-7.789	256
96	T&E	AFFTC	IJ	60	0.4103	30.38	99	2.9	-216.1	109
100	S&IO	OC-ALC	LA	10950	0.007776	-35.15	12236	0.04785	-525.5	13072
105	S&IO	OC-ALC	LG	128	0.1172	55	256	0.5556	-57.22	283
108	S&IO	OO-ALC	LA	3234	0.02632	-35.11	3614	0.1619	-525.3	3861
117	S&IO	SA-ALC	LA	1992	0.04274	-35.13	2226	0.2632	-525.8	2378
127	S&IO	SM-ALC	LA	1718	0.0495	-35.05	1920	0.3053	-526.3	2051
128	S&IO	SM-ALC	LH	1061	0.04245	4.958	1909	0.0443	1.424	2225
132	S&IO	SM-ALC	FM	43	0.1301	44.41	166	0.8095	-68.38	208
134	S&IO	SM-ALC	PK	129	0.4545	11.36	140	0.9615	-59.62	166
135	S&IO	SM-ALC	OTHER	119	0.1491	45.25	233	0.6897	-80.69	262
138	S&IO	WR-ALC	LB	1339	0.03984	31.65	1590	0.7143	-1041	1597
139	S&IO	WR-ALC	LN	1372	0.02294	28.53	1590	0.3182	-440.9	1700
141	S&IO	WR-ALC	LF	1234	0.05814	18.26	1320	0.3846	-412.7	1333
142	S&IO	WR-ALC	LK	1100	0.1613	-97.42	1131	0.2055	-147.4	1204
145	S&IO	WR-ALC	PK	269	0.3333	0.3333	284	0.7143	-107.9	291
146	S&IO	WR-ALC	FM	173	0.5625	-22.31	205	0.5	-9.5	219
147	S&IO	WR-ALC	MA	108	0.75	14	112	0.6667	23.33	115
148	S&IO	WR-ALC	OTHER	153	0.4643	3.964	181	0.8	-56.8	196
150	BOS	ASC	CE	666	0.1771	-37.94	762	0.09375	25.56	794
151	BOS	ASC	LG	432	0.2742	-38.45	494	0.1429	26.43	515
152	BOS	ASC	SC	355	0.3333	-38.33	406	0.1765	25.35	423
153	BOS	ASC	SP	263	0.4474	-37.66	301	0.2308	27.54	314
154	BOS	ASC	DM	202	0.5862	-38.41	231	0.3	27.7	241
155	BOS	ASC	SG	185	0.6538	-40.96	211	0.3333	26.67	220
156	BOS	ASC	SV	147	0.8095	-39	168	0.4286	25	175
157	BOS	ASC	FR	133	0.8947	-39	152	0.5	21	158
159	BOS	ASC	MS	80	1.545	-43.64	91	0.75	28.75	95
160	BOS	ASC	OTHER	944	0.1259	-38.87	1079	0.06667	25.07	1124
161	BOS	ESC	IS	1192	0.09942	-38.5	1363	0.05263	25.26	1420
162	BOS	ESC	LS	498	0.2394	-39.24	569	0.125	25.88	593
163	BOS	ESC	EI	356	0.3333	-38.67	407	0.1765	25.18	424

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164	BOS	ESC	SD		325	0.3617	-37.55	372	0.1875	27.25	388
165	BOS	ESC	OS		283	0.4146	-37.34	324	0.2143	27.57	338
166	BOS	ESC	LG		281	0.425	-39.42	321	0.2143	28.21	335
167	BOS	ESC	CE		198	0.6071	-40.21	226	0.3	29.2	236
168	BOS	ESC	OP		162	0.7391	-39.74	185	0.375	27.63	193
169	BOS	ESC	ES		139	0.85	-38.15	159	0.4286	28.86	166
170	BOS	ESC	PK		118	1	-38	135	0.5	29.5	141
171	BOS	ESC	SC		108	1.063	-34.75	124	0.6	22.6	129
172	BOS	ESC	DP		106	1.133	-40.13	121	0.6	24.4	126
173	BOS	ESC	SV		106	1.133	-40.13	121	0.6	24.4	126
174	BOS	ESC	PG		91	1.308	-39	104	0.75	19	108
175	BOS	ESC	SP		84	1.417	-39	96	0.75	25	100
176	BOS	ESC	OTHER		3939	0.03009	-38.52	4504	0.01579	25.88	4694
177	BOS	HSC	CE		143	0.8095	-35.76	164	0.4286	26.71	171
178	BOS	HSC	AO		130	0.8947	-36.32	149	0.5	22.5	155
179	BOS	HSC	OE		122	1	-42	139	0.5	27.5	145
180	BOS	HSC	LG		109	1.063	-35.81	125	0.6	22	130
181	BOS	HSC	DP		99	1.214	-40.21	113	0.6	29.2	118
182	BOS	HSC	SC		96	1.214	-36.57	110	0.6	31	115
183	BOS	HSC	SV		93	1.308	-41.62	106	0.75	17.5	110
184	BOS	HSC	SP		58	2.125	-43.25	66	1	31	69
185	BOS	HSC	OTHER		332	0.3542	-37.58	380	0.1875	25.75	396
188	BOS	SMC	LG		361	0.3269	-38.02	413	0.1765	24.12	430
190	BOS	SMC	CM		178	0.68	-41.04	203	0.3333	29.33	212
192	BOS	SMC	MS		118	1	-38	135	0.5	29.5	141
195	BOS	SMC	OTHER		539	0.2208	-39	616	0.1154	25.92	642
196	BOS	OC-ALC	LG		252	0.05929	55.06	505	0.283	-57.92	558
201	BOS	OC-ALC	SV		158	1.217	-132.3	181	0.5217	-6.435	204
202	BOS	OC-ALC	FM		91	2.5	-197.5	113	0.8824	-14.71	130
218	BOS	SA-ALC	DP		194	0.01429	57.23	334	0.3089	-41.19	457
220	BOS	SA-ALC	SP		163	0.5	3.5	189	0.6667	-28	192
223	BOS	SA-ALC	OS		77	1.083	1.583	89	1	9	91
225	BOS	SM-ALC	CE		438	0.07937	35.24	627	0.1648	-18.35	718
226	BOS	SM-ALC	SC		416	0.3333	-63.67	446	0.3846	-86.54	485
231	BOS	SM-ALC	EM		102	0.8333	0	108	0.9091	-8.182	119
235	BOS	WR-ALC	DP		223	0.25	24.25	263	0.5263	-48.42	282
240	BOS	WR-ALC	OTHER		580	0.2391	-62.7	626	0.13	5.62	726
243	BOS	AEDC	SC		85	0.8333	-0.8333	97	2.857	-197.1	104
247	BOS	AEDC	FM		54	1.25	22.5	58	5	-195	59
248	BOS	AEDC	OTHER		114	0.44	21.84	139	2.125	-212.4	147
251	BOS	AFDTC	SP		214	0.4889	-43.62	259	0.68	-93.12	284
252	BOS	AFDTC	SC		202	0.5116	-42.35	245	0.7083	-90.54	269
253	BOS	AFDTC	SV		175	0.5946	-43.05	212	0.8095	-88.62	233
254	BOS	AFDTC	TS		162	0.6471	-43.82	196	0.8947	-92.37	215
255	BOS	AFDTC	OS		159	0.6667	-45	192	0.8947	-88.79	211
257	BOS	AFDTC	MS		62	1.692	-43.92	75	2.429	-99.14	82
258	BOS	AFDTC	PK		52	2	-43	63	2.833	-95.5	69
259	BOS	AFDTC	OTHER		396	0.2619	-42.71	480	0.3617	-90.62	527
261	BOS	AFFTC	LG		382	0.2188	1.438	414	0.2353	-5.412	448
267	BOS	AFFTC	OTHER		415	0.3908	-113.2	502	0.3269	-81.12	554

Appendix E. Manpower Levels for Allocation Alternatives

			Lower		Upper	Peanut Butter Spread Alternatives			
MEB	Subcommand	Two-letter	Bound	Current	Bound	Alt1	Alt2	Alt3	Alt4
PM	ASC	EN	1526	1856	2033	1948	1763	1670	1577
PM	ASC	AQ	1163	1551	1551	1628	1473	1395	1318
PM	ASC	AL	623	680	724	714	646	612	578
PM	ASC	PK	616	635	680	666	603	571	539
PM	ASC	FR	382	473	500	496	449	425	402
PM	ASC	SC	376	465	491	488	441	418	395
PM	ASC	RE	0	111	115	116	105	99	94
PM	ASC	FM	92	109	115	114	103	98	92
PM	ASC	OTHER	326	404	427	424	383	363	343
PM	ESC	FF	961	1171	1281	1229	1112	1053	995
PM	ESC	TE	791	964	1054	1012	915	867	819
PM	ESC	EN	596	727	795	763	690	654	617
PM	ESC	FM	217	264	289	277	250	237	224
PM	ESC	PK	188	229	250	240	217	206	194
PM	ESC	IM	146	178	195	186	169	160	151
PM	ESC	AL	110	134	147	140	127	120	113
PM	ESC	SC	94	114	125	119	108	102	96
PM	ESC	OTHER	208	254	278	266	241	228	215
PM	HSC	YA	227	277	303	290	263	249	235
PM	HSC	PK	29	35	38	36	33	31	29
PM	HSC	FM	21	25	27	26	23	22	21
PM	HSC	SC	8	10	11	10	9	9	8
PM	HSC	OTHER	39	48	53	50	45	43	40
PM	SMC	ME	446	601	636	631	570	540	510
PM	SMC	MG	422	562	562	590	533	505	477
PM	SMC	CW	448	498	574	522	473	448	423
PM	SMC	MC	422	464	563	487	440	417	394
PM	SMC	XR	374	445	467	467	422	400	378
PM	SMC	MT	377	423	754	444	401	380	359
PM	SMC	CZ	371	400	437	420	380	360	340
PM	SMC	CE	281	351	351	368	333	315	298
PM	SMC	CL	256	349	366	366	331	314	296
PM	SMC	CY	236	284	321	298	269	255	241
PM	SMC	CU	235	283	313	297	268	254	240
PM	SMC	FM	238	283	298	297	268	254	240
PM	SMC	PK	237	281	296	295	266	252	238
PM	SMC	CI	178	194	253	203	184	174	164
PM	SMC	SD	131	167	176	175	158	150	141
PM	SMC	AL	98	123	130	129	116	110	104
PM	SMC	OTHER	361	434	491	455	412	390	368
PM	OTHER	OTHER	2729	3326	3638	3492	3159	2993	2827
S&T	WRIGHT	WD	540	658	720	690	625	592	559
S&T	WRIGHT	WB	391	477	522	500	453	429	405
S&T	WRIGHT	WF	324	395	432	414	375	355	335
S&T	WRIGHT	WE	315	384	420	403	364	345	326
S&T	WRIGHT	WR	315	384	420	403	364	345	326

Appendix E. Manpower Levels for Allocation Alternatives

S&T	WRIGHT	WC		126	153	167		160	145	137	130
S&T	WRIGHT	DJ		109	133	145		139	126	119	113
S&T	WRIGHT	PK		121	125	134		131	118	112	106
S&T	WRIGHT	WH		77	94	103		98	89	84	79
S&T	WRIGHT	OTHER		196	239	261		250	227	215	203
S&T	ROME	LR		285	348	381		365	330	313	295
S&T	ROME	LO		167	204	223		214	193	183	173
S&T	ROME	LA		126	153	167		160	145	137	130
S&T	ROME	LK		122	149	163		156	141	134	126
S&T	ROME	JX		77	94	103		98	89	84	79
S&T	ROME	OTHER		124	151	165		158	143	135	128
S&T	ARMSTRONG	HR		208	253	277		265	240	227	215
S&T	ARMSTRONG	CF		199	242	265		254	229	217	205
S&T	ARMSTRONG	DO		130	158	173		165	150	142	134
S&T	ARMSTRONG	AO		119	145	159		152	137	130	123
S&T	ARMSTRONG	OE		114	139	152		145	132	125	118
S&T	ARMSTRONG	EQ		40	49	54		51	46	44	41
S&T	ARMSTRONG	XP		35	43	47		45	40	38	36
S&T	ARMSTRONG	OTHER		15	18	20		18	17	16	15
S&T	PHILLIPS	DO		423	516	564		541	490	464	438
S&T	PHILLIPS	WS		213	260	284		273	247	234	221
S&T	PHILLIPS	GP		190	231	253		242	219	207	196
S&T	PHILLIPS	LI		170	207	226		217	196	186	175
S&T	PHILLIPS	RK		158	192	210		201	182	172	163
S&T	PHILLIPS	SX		147	179	196		187	170	161	152
S&T	PHILLIPS	VT		139	170	186		178	161	153	144
S&T	PHILLIPS	PK		109	130	137		136	123	117	110
S&T	PHILLIPS	XP		90	110	120		115	104	99	93
S&T	PHILLIPS	OTHER		117	143	156		150	135	128	121
S&T	OTHER	OTHER		331	404	442		424	383	363	343
T&E	AEDC	DO		1417	1771	1771		1859	1682	1593	1505
T&E	AEDC	CE		456	524	672		550	497	471	445
T&E	AEDC	SC		112	127	137		133	120	114	107
T&E	AEDC	OTHER		109	134	136		140	127	120	113
T&E	AFDTC	TS		994	1350	1447		1417	1282	1215	1147
T&E	AFDTC	LG		601	817	876		857	776	735	694
T&E	AFDTC	TG		448	608	652		638	577	547	516
T&E	AFDTC	DO		409	556	596		583	528	500	472
T&E	AFDTC	OG		308	419	449		439	398	377	356
T&E	AFDTC	SC		208	282	302		296	267	253	239
T&E	AFDTC	OS		84	114	122		119	108	102	96
T&E	AFDTC	OTHER		367	499	535		523	474	449	424
T&E	AFFTC	LG		1992	2161	2339		2269	2052	1944	1836
T&E	AFFTC	TS		0	1229	1386		1290	1167	1106	1044
T&E	AFFTC	DO		0	499	499		523	474	449	424
T&E	AFFTC	RG		338	450	450		472	427	405	382
T&E	AFFTC	LD		218	237	256		248	225	213	201
T&E	AFFTC	KT		152	212	231		222	201	190	180
T&E	AFFTC	SC		104	104	132		109	98	93	88

Appendix E. Manpower Levels for Allocation Alternatives

T&E	AFFTC	IJ		60	99	109		103	94	89	84
T&E	AFFTC	OS		0	98	107		102	93	88	83
T&E	AFFTC	OTHER		957	1338	1456		1404	1271	1204	1137
T&E	OTHER	OTHER		232	315	338		330	299	283	267
S&IO	OC-ALC	LA		10950	12236	13072		12847	11624	11012	10400
S&IO	OC-ALC	LI		1435	2126	2760		2232	2019	1913	1807
S&IO	OC-ALC	LP		1451	2027	2761		2128	1925	1824	1722
S&IO	OC-ALC	TI		720	987	1123		1036	937	888	838
S&IO	OC-ALC	PK		229	265	374		278	251	238	225
S&IO	OC-ALC	LG		128	256	283		268	243	230	217
S&IO	OC-ALC	FM		176	219	252		229	208	197	186
S&IO	OC-ALC	OTHER		163	236	300		247	224	212	200
S&IO	OO-ALC	LA		3234	3614	3861		3794	3433	3252	3071
S&IO	OO-ALC	LI		2244	3261	3696		3424	3097	2934	2771
S&IO	OO-ALC	LM		1699	2469	2798		2592	2345	2222	2098
S&IO	OO-ALC	TI		1087	1580	1791		1659	1501	1422	1343
S&IO	OO-ALC	LG		253	367	416		385	348	330	311
S&IO	OO-ALC	PK		182	264	299		277	250	237	224
S&IO	OO-ALC	FM		109	162	187		170	153	145	137
S&IO	OO-ALC	OTHER		167	242	274		254	229	217	205
S&IO	SA-ALC	LP		2105	3509	3859		3684	3333	3158	2982
S&IO	SA-ALC	LA		1992	2226	2378		2337	2114	2003	1892
S&IO	SA-ALC	LD		1469	1959	2155		2056	1861	1763	1665
S&IO	SA-ALC	TI		860	1191	1322		1250	1131	1071	1012
S&IO	SA-ALC	LG		309	553	648		580	525	497	470
S&IO	SA-ALC	PK		270	425	507		446	403	382	361
S&IO	SA-ALC	NW		0	382	411		401	362	343	324
S&IO	SA-ALC	LT		157	248	261		260	235	223	210
S&IO	SA-ALC	FM		142	211	243		221	200	189	179
S&IO	SA-ALC	SF		0	127	148		133	120	114	107
S&IO	SA-ALC	OTHER		166	273	303		286	259	245	232
S&IO	SM-ALC	LA		1718	1920	2051		2016	1824	1728	1632
S&IO	SM-ALC	LH		1061	1909	2225		2004	1813	1718	1622
S&IO	SM-ALC	LI		919	1458	1458		1530	1385	1312	1239
S&IO	SM-ALC	TI		1003	1432	1774		1503	1360	1288	1217
S&IO	SM-ALC	QL		168	179	211		187	170	161	152
S&IO	SM-ALC	FM		43	166	208		174	157	149	141
S&IO	SM-ALC	MA		137	153	168		160	145	137	130
S&IO	SM-ALC	PK		129	140	166		147	133	126	119
S&IO	SM-ALC	OTHER		119	233	262		244	221	209	198
S&IO	WR-ALC	TI		1410	2170	2324		2278	2061	1953	1844
S&IO	WR-ALC	LJ		1810	1964	2083		2062	1865	1767	1669
S&IO	WR-ALC	LB		1339	1590	1597		1669	1510	1431	1351
S&IO	WR-ALC	LN		1372	1590	1700		1669	1510	1431	1351
S&IO	WR-ALC	LY		1331	1433	1863		1504	1361	1289	1218
S&IO	WR-ALC	LF		1234	1320	1333		1386	1254	1188	1122
S&IO	WR-ALC	LK		1100	1131	1204		1187	1074	1017	961
S&IO	WR-ALC	LG		407	407	492		427	386	366	345
S&IO	WR-ALC	LV		22	317	356		332	301	285	269

Appendix E. Manpower Levels for Allocation Alternatives

S&IO	WR-ALC	PK		269	284	291		298	269	255	241
S&IO	WR-ALC	FM		173	205	219		215	194	184	174
S&IO	WR-ALC	MA		108	112	115		117	106	100	95
S&IO	WR-ALC	OTHER		153	181	196		190	171	162	153
S&IO	OTHER	OTHER		3853	5599	6346		5878	5319	5039	4759
BOS	ASC	CE		666	762	794		800	723	685	647
BOS	ASC	LG		432	494	515		518	469	444	419
BOS	ASC	SC		355	406	423		426	385	365	345
BOS	ASC	SP		263	301	314		316	285	270	255
BOS	ASC	DM		202	231	241		242	219	207	196
BOS	ASC	SG		185	211	220		221	200	189	179
BOS	ASC	SV		147	168	175		176	159	151	142
BOS	ASC	FR		133	152	158		159	144	136	129
BOS	ASC	PK		102	105	112		110	99	94	89
BOS	ASC	MS		80	91	95		95	86	81	77
BOS	ASC	OTHER		944	1079	1124		1132	1025	971	917
BOS	ESC	IS		1192	1363	1420		1431	1294	1226	1158
BOS	ESC	LS		498	569	593		597	540	512	483
BOS	ESC	EI		356	407	424		427	386	366	345
BOS	ESC	SD		325	372	388		390	353	334	316
BOS	ESC	OS		283	324	338		340	307	291	275
BOS	ESC	LG		281	321	335		337	304	288	272
BOS	ESC	CE		198	226	236		237	214	203	192
BOS	ESC	OP		162	185	193		194	175	166	157
BOS	ESC	ES		139	159	166		166	151	143	135
BOS	ESC	PK		118	135	141		141	128	121	114
BOS	ESC	SC		108	124	129		130	117	111	105
BOS	ESC	DP		106	121	126		127	114	108	102
BOS	ESC	SV		106	121	126		127	114	108	102
BOS	ESC	PG		91	104	108		109	98	93	88
BOS	ESC	SP		84	96	100		100	91	86	81
BOS	ESC	OTHER		3939	4504	4694		4729	4278	4053	3828
BOS	HSC	CE		143	164	171		172	155	147	139
BOS	HSC	AO		130	149	155		156	141	134	126
BOS	HSC	OE		122	139	145		145	132	125	118
BOS	HSC	LG		109	125	130		131	118	112	106
BOS	HSC	DP		99	113	118		118	107	101	96
BOS	HSC	SC		96	110	115		115	104	99	93
BOS	HSC	SV		93	106	110		111	100	95	90
BOS	HSC	SP		58	66	69		69	62	59	56
BOS	HSC	OTHER		332	380	396		399	361	342	323
BOS	SMC	CE		374	468	468		491	444	421	397
BOS	SMC	SC		354	450	473		472	427	405	382
BOS	SMC	LG		361	413	430		433	392	371	351
BOS	SMC	SP		300	375	375		393	356	337	318
BOS	SMC	CM		178	203	212		213	192	182	172
BOS	SMC	MW		105	142	142		149	134	127	120
BOS	SMC	MS		118	135	141		141	128	121	114
BOS	SMC	FM		109	130	137		136	123	117	110

Appendix E. Manpower Levels for Allocation Alternatives

BOS	SMC	DP		0	108	86		113	102	97	91
BOS	SMC	OTHER		539	616	642		646	585	554	523
BOS	OC-ALC	LG		252	505	558		530	479	454	429
BOS	OC-ALC	CE		231	487	542		511	462	438	413
BOS	OC-ALC	SC		258	343	390		360	325	308	291
BOS	OC-ALC	SP		240	301	343		316	285	270	255
BOS	OC-ALC	DP		205	273	273		286	259	245	232
BOS	OC-ALC	SV		158	181	204		190	171	162	153
BOS	OC-ALC	FM		91	113	130		118	107	101	96
BOS	OC-ALC	EM		52	100	112		105	95	90	85
BOS	OC-ALC	PK		82	95	134		99	90	85	80
BOS	OC-ALC	OS		84	87	90		91	82	78	73
BOS	OC-ALC	OTHER		228	349	397		366	331	314	296
BOS	00-ALC	CE		638	841	970		883	798	756	714
BOS	00-ALC	LG		363	479	553		502	455	431	407
BOS	00-ALC	SC		185	244	282		256	231	219	207
BOS	00-ALC	DP		153	202	233		212	191	181	171
BOS	00-ALC	SP		127	168	194		176	159	151	142
BOS	00-ALC	SV		101	133	153		139	126	119	113
BOS	00-ALC	OS		72	95	110		99	90	85	80
BOS	00-ALC	MA		83	110	127		115	104	99	93
BOS	00-ALC	OTHER		395	521	601		547	494	468	442
BOS	SA-ALC	CE		630	769	919		807	730	692	653
BOS	SA-ALC	LG		244	437	512		458	415	393	371
BOS	SA-ALC	DP		194	334	457		350	317	300	283
BOS	SA-ALC	SC		267	283	356		297	268	254	240
BOS	SA-ALC	SP		163	189	192		198	179	170	160
BOS	SA-ALC	SV		117	153	196		160	145	137	130
BOS	SA-ALC	FM		70	104	120		109	98	93	88
BOS	SA-ALC	OS		77	89	91		93	84	80	75
BOS	SA-ALC	OTHER		387	540	643		567	513	486	459
BOS	SM-ALC	CE		438	627	718		658	595	564	532
BOS	SM-ALC	SC		416	446	485		468	423	401	379
BOS	SM-ALC	LG		221	245	281		257	232	220	208
BOS	SM-ALC	DP		199	212	264		222	201	190	180
BOS	SM-ALC	SP		98	157	174		164	149	141	133
BOS	SM-ALC	SV		70	139	147		145	132	125	118
BOS	SM-ALC	EM		102	108	119		113	102	97	91
BOS	SM-ALC	OTHER		424	531	600		557	504	477	451
BOS	WR-ALC	CE		485	485	588		509	460	436	412
BOS	WR-ALC	LG		305	305	368		320	289	274	259
BOS	WR-ALC	DP		223	263	282		276	249	236	223
BOS	WR-ALC	SC		147	232	292		243	220	208	197
BOS	WR-ALC	SP		178	221	221		232	209	198	187
BOS	WR-ALC	SV		97	129	149		135	122	116	109
BOS	WR-ALC	SG		40	40	44		42	38	36	34
BOS	WR-ALC	OTHER		580	626	726		657	594	563	532
BOS	AEDC	CE		511	588	754		617	558	529	499
BOS	AEDC	MY		105	131	131		137	124	117	111

Appendix E. Manpower Levels for Allocation Alternatives

BOS	AEDC	SC		85	97	104		101	92	87	82
BOS	AEDC	DP		52	87	97		91	82	78	73
BOS	AEDC	PK		66	83	83		87	78	74	70
BOS	AEDC	SP		66	66	99		69	62	59	56
BOS	AEDC	FM		54	58	59		60	55	52	49
BOS	AEDC	OTHER		114	139	147		145	132	125	118
BOS	AFDTC	LG		621	752	825		789	714	676	639
BOS	AFDTC	CE		610	739	811		775	702	665	628
BOS	AFDTC	SP		214	259	284		271	246	233	220
BOS	AFDTC	SC		202	245	269		257	232	220	208
BOS	AFDTC	SV		175	212	233		222	201	190	180
BOS	AFDTC	TS		162	196	215		205	186	176	166
BOS	AFDTC	OS		159	192	211		201	182	172	163
BOS	AFDTC	SG		111	135	148		141	128	121	114
BOS	AFDTC	MS		62	75	82		78	71	67	63
BOS	AFDTC	PK		52	63	69		66	59	56	53
BOS	AFDTC	OTHER		396	480	527		504	456	432	408
BOS	AFFTC	CE		714	861	1007		904	817	774	731
BOS	AFFTC	LG		382	414	448		434	393	372	351
BOS	AFFTC	SP		233	404	387		424	383	363	343
BOS	AFFTC	SC		207	207	263		217	196	186	175
BOS	AFFTC	SV		8	173	181		181	164	155	147
BOS	AFFTC	DP		99	165	184		173	156	148	140
BOS	AFFTC	OS		0	50	55		52	47	45	42
BOS	AFFTC	OTHER		415	502	554		527	476	451	426
BOS	OTHER	OTHER		960	1233	1402		1294	1171	1109	1048

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Vita

Sandra K. Smith was born in 1966 in Cincinnati, Ohio. She attended Forest Park High School and graduated as valedictorian in 1984. She graduated from Miami University of Ohio in May, 1988 with a B.A. in Psychology. As an Air Force ROTC distinguished graduate, she received a commission in the USAF and reported for active duty in January 1989 at the Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio. While at ASD, she served as a life-cycle cost (LCC) analyst for the Deputy of Acquisition Logistics, Directorate of Logistics Concepts and Analysis, specializing in the LCC modeling of missile/laser warning systems for transport and fighter aircraft. Her next assignment, in 1991, was to the Armstrong Laboratory, Human Resources Division, Wright-Patterson AFB, Ohio, where she led the Air Force effort to develop Tri-Service specifications for electronic interchange of aircraft technical data for integrated maintenance information systems. She entered the Graduate School of Engineering, Air Force Institute of Technology, in August 1993.

Permanent Address: 101 Annandale Drive
Fairfield, Ohio 45014